Gas Journal

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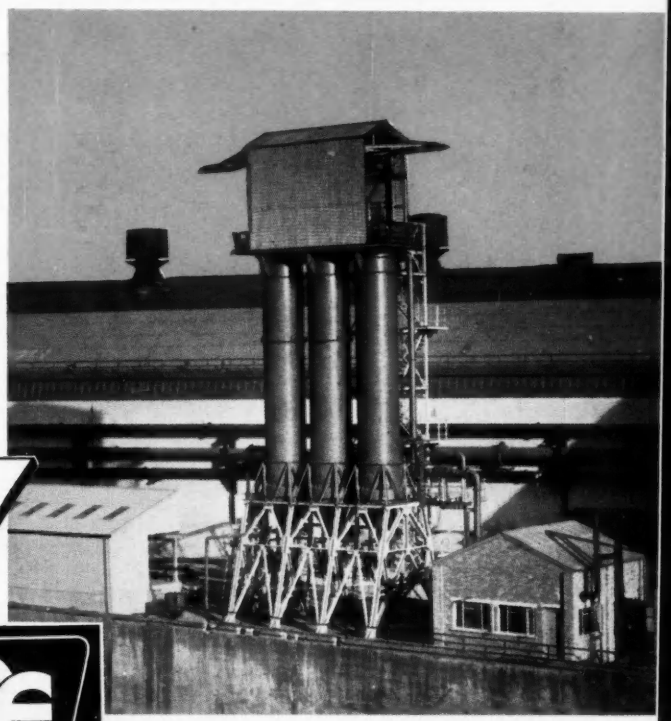

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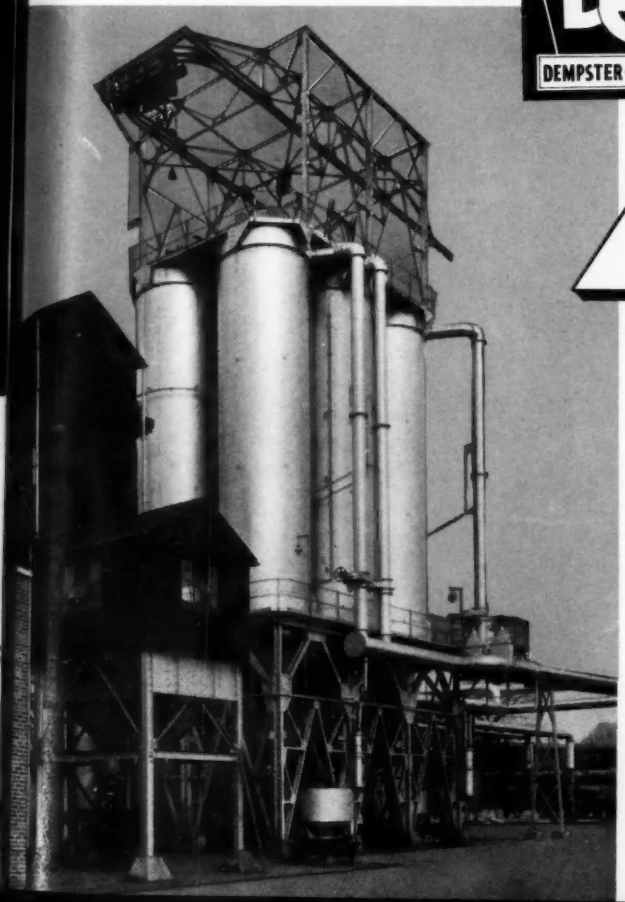

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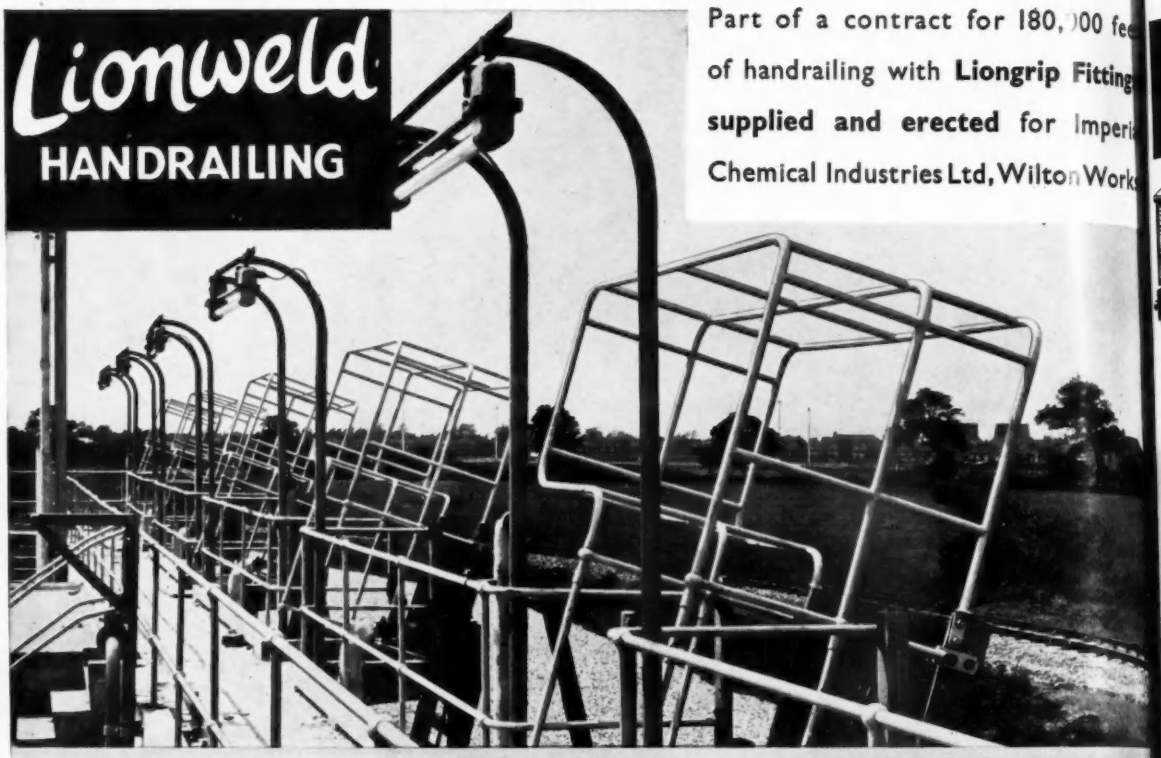

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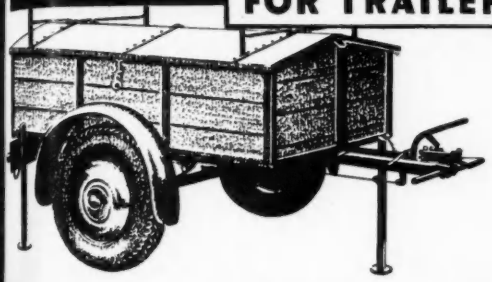

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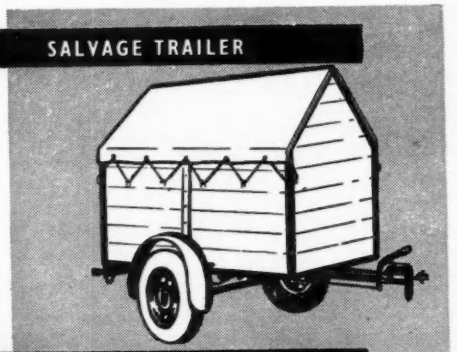

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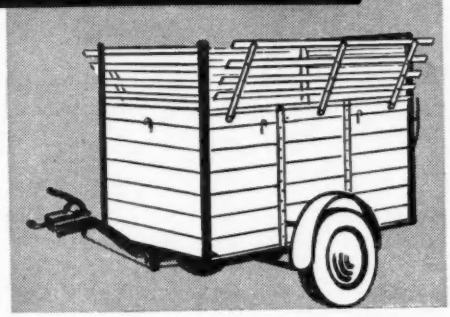

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Gas Journal

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110TH YEAR

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PUBLISHERS' NOTICE See page 237, July 30, 1958

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Gas Journal

VOLUME 295. No. 4962 AUGUST 20, 1958. 110th YEAR

The Problem of Safety

THIS week we are devoting the bulk of the 'JOURNAL' to safety in industry. The reasons for doing so are not far to seek. The problems facing all those in charge of factories—these include gasworks—building operations or the construction of pipelines, is how to reduce the number of accidents to those taking part in the work. It is not enough to improve working conditions by shortening hours of work, providing more attractive and better lit factories or better organised social activities outside working hours if there is still a grave risk of the operatives being severely injured or even killed.

Unfortunately this is not a particularly easy problem to solve. Although both employers and operatives recognise the value of safety precautions it was not until comparatively recent years possible to arouse any real interest in them except from those specialising in safety appliances and those in charge of enforcing the Factory Acts. It is difficult to analyse this curiously apathetic point of view to something of such far-reaching importance.

Some employers may perhaps look askance at the expenses involved in guarding machines, the purchase of rescue apparatus which needs to be properly maintained to be in the least effective, the careful inspection of all lifting tackle and also the ceaseless supervision to ensure that all safety precautions are being taken.

To the operative, many of the precautions may seem fussy, and therefore fit to be given the contempt he thinks they deserve. They also restrict his freedom of action and thus his self-esteem is likely to increase if he is daring enough to circumvent the prescribed safe method of carrying out the job. In addition, the adapting of old machines, especially presses doing repetition work, to the necessary safe standards is likely to be clumsy. Where piece-work rates are being paid, the closing of a guard before operating the press may interfere with output and the pay packet.

There is still likely to be a certain amount of prejudice against adopting new and rather more elaborate methods when the simpler ones have held good for so long, especially when supervision is tightened up to make sure that the safe methods are indeed being used.

The solution of these diversities of outlook can be found in improvements in the design of machinery and buildings and by making the operatives completely safety conscious. We think that both are equally important. The well-designed safe machine need be no more expensive than a badly designed accident prone machine and it will not encourage the operator to abuse it to increase output. The training of all manual workers, and management too, to become safety conscious will change this atmosphere of disinterested apathy to one of a demand for safe methods to be adopted and will encourage the management to save money on accident litigation and compensation to the disabled by realising the risks and acting accordingly.

A good safety officer should have a vocation for his work. He needs to be a skilled and resourceful engineer as well as a diplomat of high order. He must be prepared to be constantly on the alert for improving safe working conditions and be able to carry out the improvements he suggests by advising on better machine designs or perhaps even making the parts himself. He must be able to make his views perfectly clear to the management, without exciting its hostility, and to gain the full confidence of the manual worker. Fortunately he is helped by the Factory Acts which lay down minimum safety conditions and of course have the force of the law behind them, and by the British Standards Association which, particularly since the war, has had such an outstanding influence on the improvement of designs.

In this issue we have tried to show what is being done in the improvement of safety throughout industry by publishing contributions from experts in many fields.

Provan Gasworks, Glasgow

In the article on plant extensions at Provan which appeared in our last issue all illustrations, except those of the carburetted water gas plant and the electrical substation and switchboard, were provided by Woodall-Duckham Construction Co., Ltd.

SAFETY —in the gas industry

SAFETY is a subject which concerns everyone, at home, at work, and at play. From the purely personal point of view it is a simple matter of self preservation. In the home and during the normal activities of life away from work, accident prevention is a matter for individual control, but at work the position is a little more complicated and the employer has a legal obligation to provide for the safety of his employees. Individual responsibilities still exist, but the employer is charged by the Factories Acts and other statutory obligations to provide safe means of working in all the particular circumstances.

It would be an impossible task to cover industrial safety in all its aspects in one article, or even in one book, and the subject is therefore treated in general with, at times, departures into the particular in the hope of arousing your interest and active participation in the cause of accident prevention.

There appears to be a fatalistic attitude towards personal safety summed up in the well-worn phrase 'Accidents will happen,' and yet by the exercise of forethought and common-sense it is beyond doubt that accidents can be prevented. The difficulty lies in foreseeing the consequences of perhaps a single act of folly.

As in all things, accident prevention is not attained without effort, and before any success can be achieved a great deal of instruction and training is required among operatives and staff at all levels. There is perhaps inherent in most of us an urge to take a chance; some call it a calculated risk. It is, however, imperative that this urge be suppressed as it has no place in industry when applied to safety of personnel and plant.

In general, accidents are caused either through carelessness or ignorance. Carelessness by the employee in disregarding instructions, or by management in failing to give instructions, either directly or through the various levels of supervisory staff. If management fail in their responsibility, ignorance can exist both at supervisory level and among manual workers.

It has already been stated that accidents can be prevented, and this means all accidents, a fact which is irrefutable, and having established this, the problem of finding the means of prevention remains. It is an urgent problem and must be tackled promptly and effectively. Whether or not safety officers are employed is a matter for determination by top management but, irrespective of this, those responsible for the direction and supervision of labour whether on production, distribution or service and sales, have now, and will continue to have, a responsibility to ensure the safety of the labour employed through close supervision of working methods and due attention to tools and machines in operation and use.

Out of some 7 mill. workers employed in factories in this country, over 450 are killed and 160,000 injured

A 'GAS JOURNAL' Special Number

each year. The total loss to industry on account of incapacity of insured workers through industrial injuries is little short of 20 mill. man days per annum, and on each day some 60,000 operatives are absent from work as a result of industrial injuries. These are rather staggering figures and are taken from the Report on Industrial Accident Prevention issued by the Industrial Safety Sub-Committee of the National Joint Advisory Council in 1956. They leave no doubt that accident prevention must be tackled with all the resources at our command. Quite apart from the loss in productivity, the suffering and hardship caused to individuals, often through no fault of their own, is something which no man should have on his conscience, and it must be emphasized that management at all levels bear the responsibility for the present accident frequency rate and that the problem of finding the means of prevention is theirs.

Higher Rate

In the annual report of the Chief Inspector of Factories for the year 1956 presented to Parliament in January, 1958, it is recorded that there was a total of 3,047 reported accidents in gasworks of which seven were fatal.

This compared with 3,297 in the year 1955 including 14 fatal accidents, and 1,970 in the year 1939, of which 15 were fatal. In the compilation of these figures an accident means one which is either fatal or disables the workman for more than three days from earning full wages at the work at which he was employed.

For the statistically-minded the figure for 1956 showed a reduction of 7% from the previous year while the figure for all factories reduced by 2%. While this may be gratifying, accidents continue to happen and there are, of course, many more than the figure quoted which, although perhaps minor in character, cause financial loss to the victims and a reduction in productivity.

The Chief Inspector, in his report, quotes accident frequency rates for a number of industries compiled from information sent in on a voluntary basis from individual factories. These are all lost-time accidents causing disablement beyond the day of the occurrence as distinct from notifiable accidents. The 'Accident Frequency Rate' is defined as the number of lost-time accidents per 100,000 man-hours worked. The figure quoted for gasworks is 2.63 against a frequency rate of 1.737 for all industries.

It is evident, therefore, that there is much to be done in the way of accident prevention in gasworks.

Safety Practices

Safety practices in industry can be considered under three broad divisions: 1. Those covered by statute; 2. those covered by recommendation; and 3. those dictated by experience and commonsense.

1. STATUTORY REQUIREMENTS:

Legislation covering the health, safety and welfare of manual workers is little more than 100 years old and although the Factory Act, 1833, empowered the Government to appoint paid factory inspectors, it did not contain any safety precautions. In 1841 a committee appointed to examine the working of the 1833 Act reported on the need for further legislation and recommended several safety precautions. The result was that the Factory Act of 1844 included a number of safety provisions.

Further legislation followed over the years culminating in the Factories Acts of 1937 and 1948 and the rules and orders made under the provision of these Acts. Safety is covered specifically in the 1937 Act, Part 2, Safety (General Provisions), Sections 12 to 40.

In general the 1937 Act made much more provision than formerly for safety and since that time greater use has been made of the power vested in the Minister of Labour and National Service by Section 60 of the Act to make special regulations for particular industries. These regulations appear as Statutory Rules and Orders (S.R. & O.) and Statutory Instruments (S.I.).

One of the most comprehensive of these is the Building (Safety, Health and Welfare) Regulations 1948 (S.I. 1948, No. 1145).

There has also been a series of certificates of exemption issued under Sections 23, 28 and 32 of the 1937 Act and details of such regulations, orders, rules, etc., are published in collective form by Her Majesty's Stationery Office under the title *Factory Orders.*

Redgrave's Factories Truck and Shop Acts gives the Factories Acts in detail with explanatory notes and also the various amending and additional legislation in this connection. Earlier enactments still in force are included in both publications which therefore provide a complete guide to legal requirements.

Factories Acts 1937 and 1948:

It should be realised that breaches of any of the provisions of the Factories Acts, no matter how small, or apparently trivial, are breaches of the law and as such are punishable in the courts. It is a matter of prime importance that every effort be made to comply in full with every provision of the Factories Acts, and there can be no excuse for not so doing.

In addition to the obligations placed on the occupier of a factory, Section 119(1) of the 1937 Act places a duty on persons employed not to 'Wilfully interfere with or misuse any means, appliance, convenience or other thing provided in pursuance of this Act for securing the health, safety or welfare of the persons employed in the factory or place where any means or appliance for securing health or safety is provided for the use of any such person under this Act he shall use the means or appliance'; and Section 119(2) provides that 'No person employed in a factory or in any other place to which any provisions of this Act apply shall wilfully and without reasonable cause do anything likely to endanger himself or others.'

Failure to comply with the provisions of this section is an offence for which a penalty may be imposed by law.

Both Responsible

While, therefore, the employer has the major part to play in promoting accident prevention, the employee is also charged with the responsibility of taking proper advantage of all measures taken to provide for his safety.

Chemical Works Regulations 1922:

The Regulations set out specific safety provisions which do not apply to gasworks in general, but cover certain processes such as tar distillation, and recovery of ammonia, and the Regulations therefore apply in works where these operations are carried out.

Locomotives and Wagons (Used on Lines and Sidings) Regulations 1906:

These apply to works equipped with railway sidings and impose safety

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T. B. LIVINGSTONE, ***M.Inst.Gas E., Production Engineer, Central Division, Scottish Gas Board, wrote this article.***

Industrial safety propaganda by the Royal Society for the Prevention of Accidents.

measures in connection with the operation of the sidings and their equipment.

The Building (Safety Health and Welfare) Regulations 1948:

These apply to many operations carried out in gasworks and in main-laying operations. The safety provisions cover a wide field and a detailed study should be made of the Regulations.

The Petroleum (Consolidation) Act 1928:

Imposes certain conditions and restrictions with regard to the storage of petroleum or petroleum based material having a flash point of 73°F. or under.

General:

The Acts, Instruments and Orders already mentioned cover in general a great number of safety provisions which, if complied with as required by law, would prevent many accidents taking place.

It is not necessary to expound on legal obligations or to paraphrase the various requirements; the documents are available to all and should be studied.

It is the duty of Her Majesty's Inspectors of Factories to enforce the law, to assist management in complying with the law, and in so doing ensure for employees the protection of the law.

The Inspectors have a difficult task to perform and have to cover a very wide range of operations. They are all most eager to assist in the cause of accident prevention and it will be found that their advice and assistance is always freely and willingly given.

It should be clearly understood that when they report a fault following a visit to a factory they are usually drawing attention to a breach of law. By so doing they are giving management the opportunity of voluntary compliance, and prompt advantage should be taken of it.

In the issue of '*Industrial Accident Prevention Bulletin* (RoSPA) dated May, 1956, there appeared a list of 50 questions on the Factories Acts and these are reproduced in Appendix I as a reminder of the obligations.

2. RECOMMENDATIONS AND REQUIREMENTS.

As distinct from the legal requirements covered in the preceding section, there are in existence a great number of recommendations and requirements formulated by sections of industry, individual firms, professional bodies and the like; and in addition, of course, there is a wealth of information published by the Royal Society for the Prevention of Accidents.

Safety News, Industrial Accident Prevention Bulletin and *Industrial Safety Abstracts* are published monthly by the Society and *The British Journal of Industrial Safety* quarterly. Copies are, or should be, circulated widely among appropriate officers at all levels.

Safety Recommendations issued by the Institution of Gas Engineers covers a variety of operations and practices specifically related to the gas industry and the various provisions and practices described therein should be much more widely known and adopted than appears to be the case.

In particular might be mentioned the practice of issuing 'Permit to Work' cards. Far too many operations in gasworks are treated as commonplace, and familiarity breeds contempt; the discipline required by the use of such cards is of assistance in the orderly operation of a works and their use serves to emphasise the need for due care and attention to detail.

Section M5 of this publication, 'Bibliography of Literature Relating to Accident Prevention' lists a number of publications which should be studied; some are mentioned in following paragraphs. The third paragraph of the bibliography presupposes a full knowledge of the provisions of the Factories Acts by readers, a glance at the questions in Appendix I may reveal some lapses of memory.

I.C.I. Engineering Codes and Regulations (Safety) published by the Royal Society for the Prevention of Accidents is a particularly valuable series and should be carefully studied.

Mention must also be made of the British Standards Institution: There are a number of standards covering design and codes of practice which make a valuable addition to accident prevention measures. B.S.1710:1951—Colour Identification of Pipe Lines, and the recently issued B.S.2929:1957—Safety Colours for Use in Industry, deserve attention.

The adoption of these standards, especially the latter, should be of assistance in preventing many accidents due to hazards not sufficiently identified as such. B.S.2929 recommends only three colours to be used—red, orange-yellow and green. Red to indicate 'stop'; orange-yellow 'warning of danger'; and green to identify safety equipment, escape route, first-aid point, *etc.*

In a court of law, when a claim for damages is made as a result of an accident, the outcome usually depends

on the answer to the simple question: 'Did the accident happen due to adequate steps not being taken to prevent it?' In other words, a factory owner must ensure that every employee is protected from himself; and this can be taken to mean the folly of his own acts, as it is an obligation so to equip a factory that every action taken by an employee is taken in safety.

The statement that workers must always be protected from themselves does not mean that they are inherently careless or unheeding of the dangers which surround them. They are required to perform a task and unless properly instructed and provided with the essential tools to undertake the task, they will carry it out in their own way and with the tools that come easily to hand. It must be ensured that their way is the correct way: A way which has been explained and demonstrated by those in control; and supervision must be continually exercised to ensure compliance. It must also be ensured that the tools available for carrying out the various tasks are adequate for the purpose and are maintained in a safe condition.

It has been said that the quality of an army can be measured by the quality of the N.C.O.s. This, like so many similar statements, is but a half-truth, but the N.C.O. is vital in the maintenance of discipline. Military-type discipline is neither desirable nor necessary in a gasworks, but discipline there must be to ensure that work is carried out in an orderly and controlled manner. Just as a particular task is explained to a workman so is a particular safety measure capable of definition, and just as the work is inspected in progress so should the safe execution of the work receive due attention.

This is the responsibility of the foreman and his immediate seniors, but they must be armed with the necessary knowledge and the means of applying their knowledge, and this is the responsibility of the management.

'Falls of Persons'

There is little point in issuing instructions on what to do without an accompanying instruction on how to do it. The theme of the forthcoming Industrial Safety Week is to be 'Falls of Persons.' Persons fall from ladders and ladders must be maintained in a proper manner. Appendix II, 'Inspection and Testing of Ladders,' taken from the *British Journal of Industrial Safety*, is an example of the supplementary information to accompany the instruction, 'all ladders must be maintained in a safe condition.

Codes of practice for a specific industry are especially valuable in covering those aspects of the work capable of precise definition and it should be the aim of all industries to produce codes of practice covering as many as possible of the operations carried out. This achieves the dual purpose of attaining efficiency with safety in operation.

It is possibly true to say that this section could well be summed up by stating that it is important to comply with the spirit of the law in addition to the letter of the law. One must first know the law and then apply it, and in application attempt to perfect the provisions of the various enactments.

3. EXPERIENCE AND COMMONSENSE:

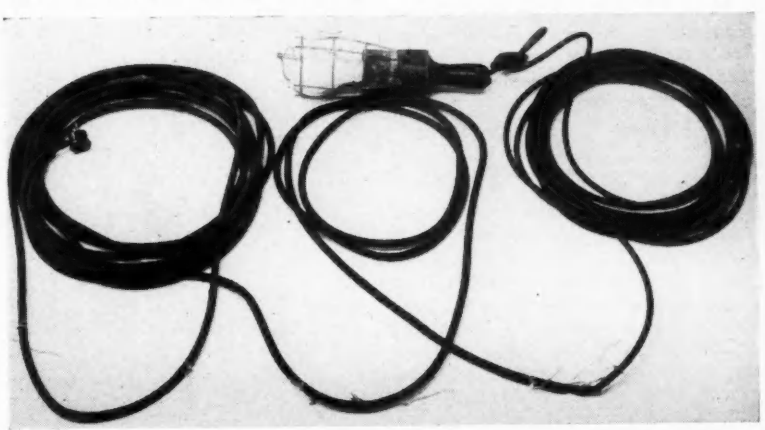
It would naturally follow that the experience and commonsense of a large number of people would be written into any Safety Codes adopted in any particular industry; and in this connection one can only draw on personal experience which is often the result of actual mishaps which have occurred to oneself or have been witnessed. It can also be the result of reading or the contacts made with others both within the particular industry and with those connected with other industries.

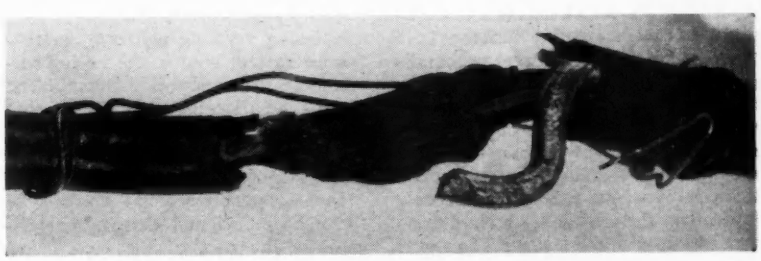
The gas industry has a reasonable record of safety, but 'reasonable' is hardly good enough and every effort must be made to make it a completely safe industry. This requires effort not only by those in management, but by all grades from top to bottom. If an example is not set by management or no interest is shown, it is much more difficult to arouse interest down the line and to inculcate any degree of safety consciousness, for it is only by this means that prevention can be achieved.

Competitive Spirit

At this point it might perhaps be appropriate to suggest that a spirit of competition between area boards in accident prevention might be officially encouraged. There is a First Aid trophy, why not one for accident prevention, judged on the accident frequency rate?

Most people employed in the gas industry have been personally involved in accidents; fortunately most of these would be of a minor character: They will also have seen accidents happen to others; or, more accurately perhaps, been employed in works where accidents have occurred ranging from the minor to those of such a serious nature that they resulted in the death of the persons concerned. In all these cases there is not the slightest doubt that the accidents were avoidable, by the per-





Perished and badly repaired flexible lead, leaking from which caused a man's death. He was holding the joint shown in the second photograph. (Reproduced from 'Electrical Accidents and Their Causes, 1955,' by permission of the Controller, H.M.S.O.)

sons to whom they happened or by those who caused them to happen, or, by negligence, allowed them to happen. There would not necessarily be any deliberate breach of rules or regulations; they would result from carelessness, lack of instruction, or ignorance of the potential danger.

It is true that one learns by experience, but there is no need for each person to go through the same experience physically. In this respect sound instruction can prove of great benefit.

It is essential that rules and regulations accepted as standard practice be rigidly enforced, having made sure initially that all concerned realise as fully as possible the reason for adopting the prescribed practices. It is amazing how often there is complete ignorance of the potential danger attached to many operations if carried out in the wrong manner.

It is an unfortunate fact that operations carried out on the works become so familiar that many of the inherent dangers associated with quite ordinary practices go unrecognised. It is well known how easily a mishap can occur and how simple it would have been to prevent it; but it is one thing to be wise after the event and quite another to be able to see hidden dangers. Staff at all levels are exhorted repeatedly to go about their duties 'with eyes that see' and perhaps to this might be added 'foresee,' for accident prevention requires just this quality. In how many works, for example, are conveyor chains started up by an operative who cannot see the chain for perhaps more than 25% of its length?

'Could It?'

There are, of course, innumerable examples of this kind and possibly it may be true that no accident has yet occurred through such an action, but it is suggested that the criterion should not be 'has it happened?' but 'could it happen?' If the answer is yes, some means of prevention must be sought.

Many accidents take place due to the apparently inexplicable action of operatives. One such accident involved a lip-bucket conveyor running in a wide trench below floor level and totally enclosed at floor level with the exception of a narrow opening about 18 in. wide running the length of the trench and slightly narrower than the width of the buckets. The floor area round the conveyor was fenced off, the only operatives there while it was in motion were a stoker and a trainee. The stoker was actively engaged in discharging coke into a travelling bogey, the other man immediately prior to the accident was engaged in brushing the floor inside the railing. He fell into the moving conveyor and was fortunate to escape with no more than a broken leg.

But for the presence of mind of the stoker with him in using an emergency stop-button to halt the conveyor he would probably have lost his life. The injured man could not subsequently explain how the mishap occurred. He knew the conveyor was there; he knew that it was moving, and yet in he went.

Better Chance

It is not known whether the accident could have been prevented by the employers with the equipment as installed, but at the next major alteration to that particular plant, opportunity was taken to strip all protective covering from the conveyor and leave the wide-open trench spanned by the discharging skip to which was attached a working platform suitably fenced and, of course, the railing surrounding the area was retained. The theory behind this alteration being that if a man fell into the trench he now had a better chance of falling clear of the conveyor.

The imprint of a man killed working at this belt while in motion. (Reproduced from 'Accidents,' by permission of the Controller, H.M.S.O.)

In judgment one could say lack of foresight in original design, carelessness on the part of the victim and faulty instruction on the part of the stoker or the management.

An another works where emphasis was laid on order and cleanliness the engineer and manager came to a section of the plant where a young technical assistant was working and on inspection pointed out that the guard was not fitted on a small electric motor. Immediately he left, the guard was found and the young man proceeded to attach it to the motor, unfortunately the isolating switch was faulty and a main switch situated outside the building controlled the circuit which was live. The guard being fitted came in contact with the brush gear and the motor casing and the technical assistant proceeded rapidly in one direction and the guard in the other. Fortunately, only his feelings were hurt but he learned early the value of adequate maintenance and safe-working methods with regard to electrical equipment.

In this case faulty maintenance and lack of supervision over maintenance workers could have caused a serious accident.

Many who have worked in a laboratory discover for themselves the wisdom of inserting a thermometer or glass tube into a cork in the approved manner which does not necessitate the entry of the broken thermometer or tube into the palm of the hand. There are scars on many hands serving as perpetual reminds of the consequences of disregarding a training instruction.

While on the subject of laboratories an illustration comes to mind of the importance of realising the nature of chemicals being used. A young junior chemist on completing a particular task lit a cigarette and proceeded to the sink to wash his hands. He turned on the hot water and two minutes afterwards recoiled before the flash-ignition of carbon bisulphide vapours. He had been using the liquid previously and had poured some down the sink. The hot water being run into the sink vaporised the liquid and the cigarette did the rest. It was possibly the last occasion on which he used a sink to dispose of an inflammable liquid. This young man had failed to realise the potential danger associated with his ignorance or laziness in disposal of a dangerous liquid.

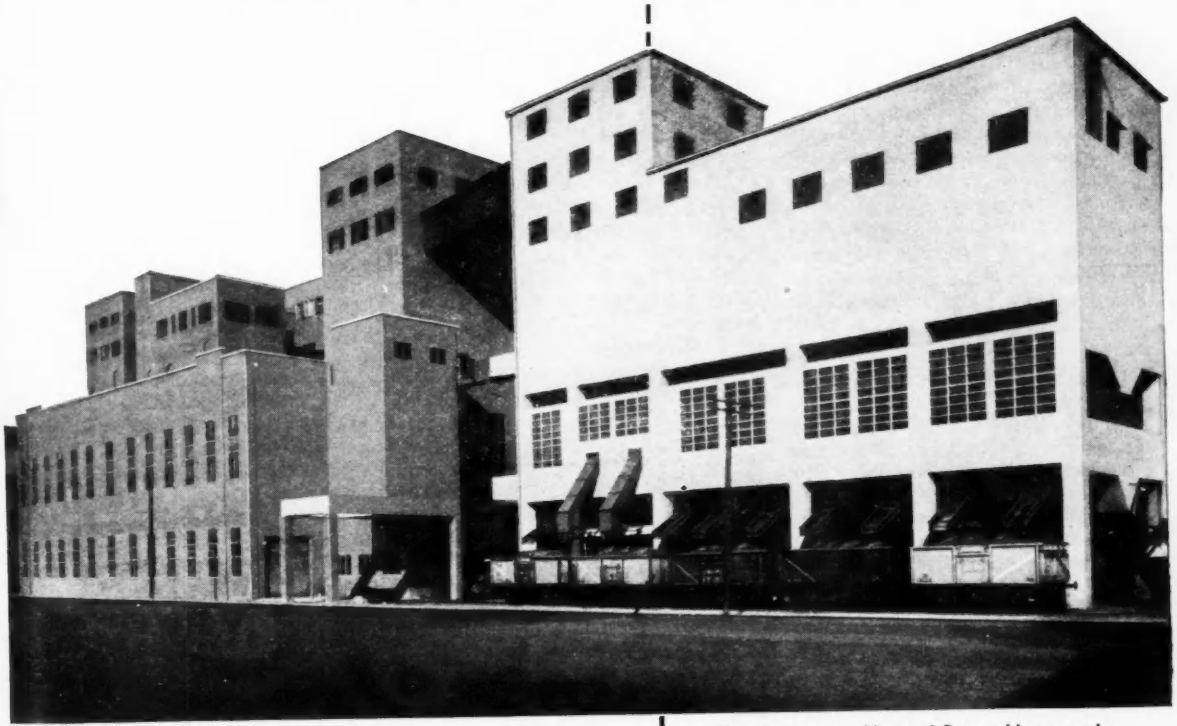
Strenuous Efforts

It is of prime importance that strenuous efforts be made to educate and train employees at all levels in accident prevention. It must be realised that what may appear to be commonsense procedure as a result of one's own knowledge and experience may not so appear to others due to lack of training.

It is of little advantage to issue lists of 'dont's' without explanation of why one should not and constant

PROVAN WORKS OF THE SCOTTISH GAS BOARD

The New Continuous Vertical Retort Installation at the Glasgow Provan Works of the Scottish Gas Board. Two benches each of twenty-four Lambent Heated Continuous Vertical Retorts capable of carbonising 435 tons of coal daily and of producing therefrom over 7 M. cubic feet of 450 B.t.u. gas and complete with Coal and Coke Handling and Coke Screening and Storage Plants.



The Continuous Vertical Retort House and Coke Screening and Storage Plant.

WOODALL-DUCKHAM CONSTRUCTION COMPANY LTD.

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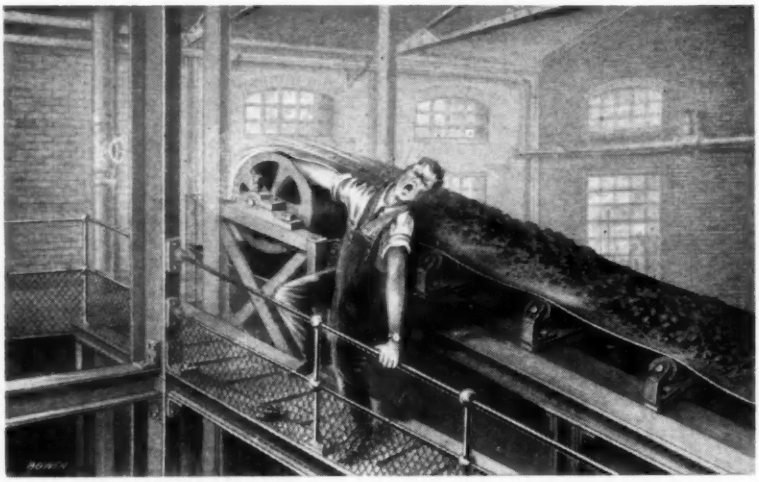


Intake between belt and pulley unguarded. (Reproduced from 'Accidents,' by permission of the Controller, H.M.S.O.)

supervision to ensure that in future they do not. For instance, the man who claims to be unaffected by gas should have it explained to him that it is unlikely that his body is served by a bloodstream completely different to that of other people, and that possibly his immunity so far has been due to lack of exposure rather than possession of unusual physical attributes.

Gentle Reminder

It should also be pointed out that a gas explosion is not caused by accident, but is the inevitable result of the ignition of a mixture of gas and air in the requisite proportions.

The following piece of doggerel appeared many years ago in one of the Charities' Day publications of the Glasgow University Students—it is quite apt:

'The smell o' gas
Ascends to pass
Through houses and through manholes
It also will explode
Begoad
If sought by lighted candles.'

Section 67 of the Gas Act, 1948, gives to the Minister of Power authority to make such regulations as he thinks fit for the purpose of securing that the public is, so far as practicable, protected from any personal injury from fire, explosion or other dangers arising from the distribution of gas by an area board.

In addition, therefore, to safeguarding their own employees the area boards have a responsibility to the public and great emphasis is given to careful workmanship, testing of distribution systems, attention to leakages and so on. It is, however, the thoroughness of instruction in safety practices, the skill of operatives in their work and the zeal of supervisors in their inspection of work and methods, that give effect to the safety measures laid down by law, order or recommendation.

No problem is capable of solution until its extent is known and accident prevention is no exception. It is essential, therefore, that all accidents, no matter how trivial, be recorded and fully investigated. It is even more important that the records be studied and action taken where appropriate to prevent recurrence. The widest possible publicity should be given in all works and depots to the accident rate and the records should be examined and discussed by works committees, joint consultative committees, engineers' committees and so on.

Responsible to Public

It will be realised that publicity, in itself, is only a means to an end and it is again emphasised that 'to issue instructions is not enough; it is essential to see that the instructions are carried out.' It is alarming to see records of accidents that would not have occurred if only instructions had been issued, supervision exercised and commonsense used.

Dr. D. G. Waddell, Medical Officer of the Scottish Gas Board, in a recent paper quoted Sir Thomas Legge, first Medical Inspector of Factories, as follows:—

'Unless and until the employer has done everything—and everything means a good deal—the workman can do next to nothing to protect himself, although he is naturally willing to do so . . . . If you can bring some influence to bear external to the workman (that is, one over which he has no control) you will be successful; and if you cannot or do not, you will never be wholly successful.'

That something can be done and done successfully is beyond doubt.

Achievement of I.C.I.

Sir Ewart Smith, Deputy Chairman of Imperial Chemical Industries Ltd., in an address to a conference organised by the London Master Builders' Association in 1957, reported that in his Company from 1943 to 1946 the accident frequency rate was very steady at about 2.7. In 1949 it was down to 1.7; in 1953 it was 1.0; and in 1956 it was 0.65. It is understood that the figure for 1957 was under 0.5, ample evidence that effective effort in the cause of accident prevention can produce results. The alkali division of this Company recently operated for two months without a lost-time accident. The division employs about 8,000 men in its 11 works which means that they ran for about 2¾ mill. man hours without an accident. At a gasworks employing 500 men this would mean operating for something like 2½ years without an accident, and in order to achieve an accident frequency rate of 0.5 at such a gasworks only six lost time accidents per annum could occur and these accidents need only mean one lost day each. This gives some measure of the achievement of Imperial Chemical Industries Ltd.

Cut Down the Rate

Each year there is presented for competition by the Royal Society for the Prevention of Accidents, the Sir George Earle Trophy, which is awarded for a notable contribution to industrial safety by any industrial or other organisation. The 1958 award has been made to Imperial Chemical Industries Ltd., and it is a well deserved recognition of the achievements of this great Company in accident prevention. Whether or not the award is ever made within the gas industry there is no reason why the efforts of this year's winner cannot be matched, and this can only be done by a concentrated effort by employees at all levels. There is no reason why the effort should not start now to decimate the accident frequency rate.

'SPARKS'

A SPARK is a burning particle. The heat varies with different metals and alloys—the burning of 1 gramme of bronze produces 300 calories; the burning of 1 gramme of steel produces 600 calories; the burning of 1 gramme of iron produces 1,600 calories.

A spark occurs when the quantity of energy produced by work, such as grinding or hammering, is unable to be dissipated in other ways such as deformation or heat conduction. Bronze has a good conductivity and, also, heat resisting oxide opposing heat build up. The harder the material being worked the greater the induced energy.

The problem of the safety tool manufacturer is to choose materials with the correct properties which will give a reasonable life at a reasonable cost. The function and circumstances in which the specific tool is to be used will influence his selection. The commonest example of frictional sparks is the cigarette lighter.

A steel abrasive wheel grinds a piece of flint, the sparks from which ignite the fuel vapour. The so-called flint is actually a soft mixture of the metals cerium and zinc—cerium is very readily oxidised which accounts for the immediate availability of bright sparks.

The energy expended in grinding is converted by friction into heat which raises the temperature of the ground-off metal particle sufficiently to promote burning, that is, oxidation, which results in still more heat.

A conventional steel tool *lightly* touched on a grindstone surface will immediately produce a shower of white hot sparks travelling an appreciable distance before cooling and disappearing. A safety tool *pressed* against a grindstone surface will after a definite lapse produce a few dull red sparks of very short life, cooling and disappearing within a very close distance of the point of origin.

A steel sledge hammer used against a steel chisel will produce a shower of hot sparks on impact, but substitute a non-sparking hammer and non-sparking chisel and no sparks will be produced. There have been many instances where the production of sparks under dangerous atmospherical conditions have resulted in the loss of life and large financial loss.

A sailor dropped a steel hammer on to the steel deck of a tanker and produced sparks!

A petrol storage worker attempted to remove a broken stud from a tank with a steel hammer and steel chisel and produced sparks!

An explosion would not have been caused in either of these cases if non-sparking safety tools had been issued to the men concerned.

It is not advisable to use non-sparking hammers with steel tools or vice-versa, because of the possibility of fracture of steel particles producing a grinding action.

Hard faced sledge hammers should not be used on concrete or brick where a spark may arise from the grinding of stone particles irrespective of whether they are non-sparking or steel hammers, but in places where sparks create a hazard the latter situation is not likely to arise.

A steel chisel may produce a spark as a function of a grinding action on being driven into hard material.

There is no British Standard Specification for the manufacture of safety tools, but a report has been made by the Industrial Research Laboratories, Birmingham, on the spark resistant tools made by Charles Carr Ltd., of Birmingham, from their 'Lily' brand non-sparking, non-magnetic alloy.

Tools tested included hammer heads (engineers' ball pein type), 1 in. cold chisels, ¾ in. spanners (single ended), 2½ in. scrapers (single ended), and 2 in. scrapers (double ended).

Tests carried out with the hammer heads included striking a steel cold chisel head while clamped in a vice and in the cutting of a piece of mild steel; and glancing blows on anvil surface; and glancing blows on vice jaws.

With cold chisels tests comprised striking on head with 2-lb. engineers' hammer (steel) while clamped in vice, while cutting mild steel, and while cutting aluminium alloy.

With single end spanners the tests included striking the handle end with an engineer's hammer (steel) while clamped in a vice and while tightening up a ¾ in. steel nut.

With all tools tests included grinding with a 12 in. diameter carborundum wheel A60/N5/V30 type, at 1,430 r.p.m., and dropping from a height of 20 ft. on to a mild steel plate and a concrete paving flag.

'No spark or burning particle formation was detected in any of these tests,' the report states. But 'in similar tests carried out with steel tools (scrapers excepted) sparking was produced in several circumstances,' it concludes.

Beryllium Copper Safety Non-spark Tools

IN industries whose work involves the use or manufacture of volatile liquids, explosive gases and inflammable materials, sparks have always constituted a grave menace. During the past few decades there has been considerable advancement and development in the gas, petroleum, explosives, paint and general chemical industries and it is principally in undertakings of this description that attention has been paid to the danger of accidental sparking.

Sparks are known to arise from a variety of causes and one of these which has constantly been a source of worry is the sparking of tools which must, of necessity, be employed in the industry. Prior to the advent of industries where dangerous atmospheres were present, all tools used were of ferrous metals and these were continued in use in spite of the known dangers attaching to them, as no suitable alternative material was available. Unfortunately, sparking is a property inherent in all ferrous metals and can never be entirely eliminated.

The origin of sparks in ferrous tools can be attributed to two main causes. First frictional heat and secondly heat due to rapid oxidation. A small particle of metal is removed from the main body due to impact force and certain frictional heat is generated as a result.

Added to this is the more intense heat caused by the rapid oxidation of the newly exposed surface. This heat

is generated far more rapidly than it can be dissipated and raises the temperature of the particle to incandescence and thus makes it visible as a spark.

In copper-based alloys, however, due to the difference in thermal conductivity, the oxidation heat is lower than that in ferrous metals and the loss of heat into the air is generally greater than the heat of oxidation. Consequently incandescence does not take place and sparking from copper alloys is virtually eliminated.

With this knowledge in mind it was possible to foresee the progressive replacement of ferrous by non-ferrous tools. The many copper based alloys were, of course, considered as their specific gravities are similar to those of the various steels and consequently the sizes of the tools produced would be very similar to their counterparts in steel.

The obvious disadvantages of the use of copper alloys lay in their lower hardness and tensile strength in relation to steel. Many alloys have been tried but only few of these are of real practical use, the remainder being too soft.

A lengthy period of testing has proved beryllium copper to be the most suitable of all copper based alloys. It is an alloy which can be formed and subsequently hardened by heat treatment.

Tools made from beryllium copper are, as the occasion demands, cast, wrought or manufactured from sheet. The metal has a hardness equivalent to that of a good quality steel and a tensile strength of over 75 tons p.s.i.

All types of hand and pneumatic tools are produced in beryllium copper and there is practically no conventional or non-standard steel tool which cannot be reproduced in this material. Beryllium copper is highly resistant to corrosion and can be confidently used in coastal areas as its resistance to corrosion from sea water and salt atmosphere is greatly superior to that of many other metals.

This quality, combined with its non-pyrophoric qualities, has made it exceptionally valuable in coastal oil and gas installations in tropical regions where the atmospheric brine concentration is so high. Beryllium copper, having no ferrous content, is also non-magnetic and confers the additional advantage of use on and in the vicinity of sensitive instruments.

Main users of Telcon beryllium copper tools—available in this country from Beryllium and Copper Alloys (Safety Tools), Ltd., of 47, Victoria Street, London, S.W.1—include the gas boards, petroleum and oil refiners, paint and chemical manufacturers, ordnance factories, atomic weapons undertakings and many Government departments.

Klaxon Audible Warning Equipment

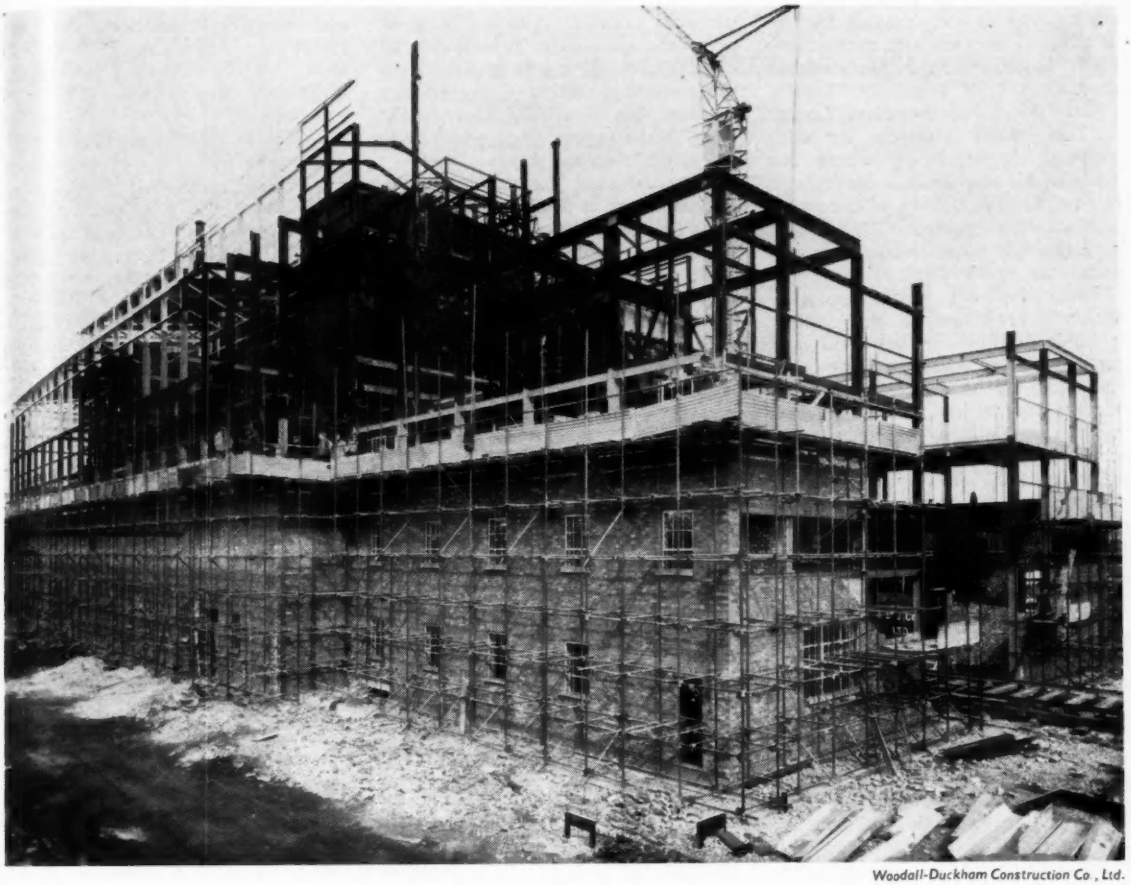
WARNING signal equipment by Klaxon, Ltd., is well known in the gas industry for giving the alarm in cases of failure of plant or machinery. Among such equipment are motor driven, hand operated, and pneumatically operated horns. The effective distances over which the available types may be heard varies between 250 yards and three miles in still air.

This firm also manufactures factory buzzers for use in both normally quiet and noisy places. Models are available in flame proof cases for use in mines or inflammable atmospheres.

Other products made by Klaxon, Ltd., whose address is 49, Upper Brook Street, London, W.1, include flasher units for directional indicators in the motor industry, fractional horsepower electric motors varying from 1 to 1/400 h.p.—the latter are used for driving electrically operated measuring instruments and use low voltage D.C. current—and electric air syrens driven by enclosed motors.

The largest of these has a range of 5 miles in still air. Geared electric motors for a low output speed and low torque are also one of their products.

Steel toe-caps to B.S.I. Specification Grade 1 (953/1952) are built in to these Greengate boots, to provide maximum protection where the going is tough. Made of high-grade rubber, they have special cleated soles for positive grip, and reinforced vamps. The Greengate range includes knee, three-quarter and ankle lengths—with or without steel toe-caps. And Greengate waterproof protective clothing, also manufactured by the Greengate & Irwell Rubber Co. Ltd., of Greengate, Manchester, 3, saves valuable man-hours by minimising absence through illness—indeed, it is claimed to pay for itself with every two or three days of absence saved. The coat, three-quarter or full length, is well ventilated and all seams on coat and leggings are double stripped and taped to make them absolutely watertight.



Woodall-Duckham Construction Co., Ltd.

SAFETY AND THE CONTRACTOR

FOR the purpose of considering the work and influence of the contractor in the province of occupational safety, it will be necessary to limit the term 'contractor' to any establishment which undertakes building operations or works of engineering construction, as defined by section 152 of the Factories Act, 1937.

It is this type of organisation which encounters the more formidable problems of accident prevention. It has, in fact, a threefold responsibility. During the course of construction, the employers must look after the safety of their own workmen, and they must also observe their common law duty of care towards anybody who comes within the orbit of their operations. When the work is completed, the product should be safe for other persons to use. If it is a large piece of equipment this means, in general terms, that it must be soundly constructed and provided with safe access, good lighting and ventilation, free from fire hazards, and fitted with effective guards for machinery. Where specialised processes are involved, the contractor may also have to incorporate special safeguards such as electronic warning devices, sequence interlocking systems, flameproof equipment, and so on.

BY

B. A. C. Whyte

SAFETY OFFICER,
WOODALL-DUCKHAM
CONSTRUCTION CO., LTD.

The latter problems, however, are largely matters of engineering design and technique; by far the greater difficulty for the contractor is that of accident prevention during construction. Those who are concerned solely with safety in factories do not always realise the extent of the forces of mischance which are ranged against the conscientious builder!

Let us consider the case where a firm is erecting a new piece of gasworks plant enclosed in a building. In the early stages of the job he will probably employ rough labour for the excavation work, and some casual skilled men to follow up with timbering and formwork. The chances are that very few of these men will have had previous experience of a gasworks contract, and, as with all large industrial premises, there will be many potential—if not actual—hazards present until the men get accustomed to their surroundings. I think it is

true to say that such hazards are not absolute: They vary with each individual's familiarity with his environment.

Now this is an important feature and one which produces the contractor's biggest worry where the safety of his employees is concerned: The ever-shifting pattern of the operations under his control. This danger is particularly potent where means of access are involved.

Every day the scene changes—trenches are opened and filled; scaffolds go up, are extended and come down; gangways are put down and taken up or diverted. So, with our hypothetical job, we have our new recruits gradually getting accustomed to the groundwork, then presently a squad of steel erectors arrives and soon the whole character of the job changes. It becomes three-dimensional. Height is added to the job, and with it the menace of falling tools and materials.

Not only access but constructional equipment—machine saws, portable electric tools, temporary lighting, hoists—all the paraphernalia of the modern contractor—gives rise to new perils. For here again we find changing conditions, and unexpected encounters with electrical gear and dangerous machinery.

In addition to all these difficulties, the contractor is usually faced with the disadvantage of having to operate many contracts by remote control. He does so, of course, by means of a system of supervision which originates at management level at the head or district office, and is put into effect by the staff at the site. There will probably be visiting officials, and, if the contract comes within the Building Regulations, there will be a person appointed under Regulation 98 to supervise the safe conduct of work.

Essential Ingredient

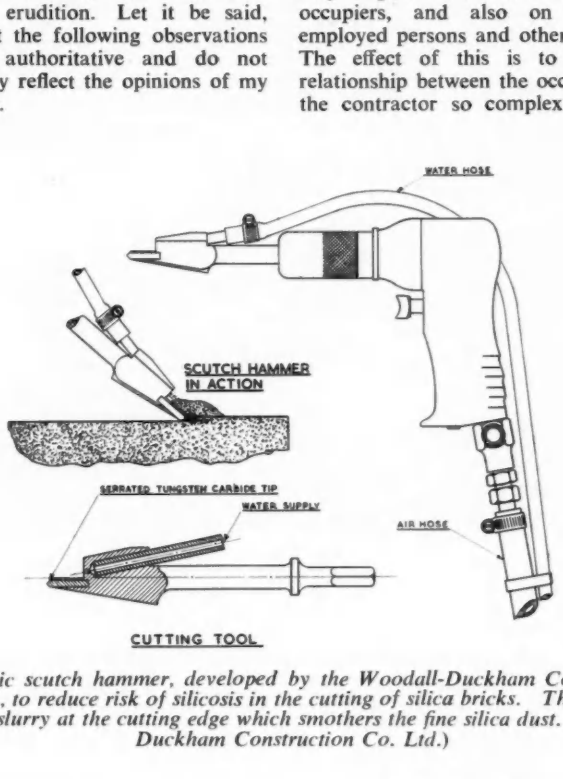
What does this add up to in terms of accident prevention? The answer, I think, depends first upon the attitude of the higher management towards safety. It must be strong enough to spread outwards and make itself felt by every member of the construction staff. If the management can elicit a response from the site supervision then something will be achieved. If the response is keen, rather more headway will be gained. But even then the job will not be 'safe.' The essential ingredient missing is the co-operation of the workmen. Real safety—that is to say, safety as measured by the uncertain standards of life outside working hours—will only be achieved when every person on the job possesses sufficient skill and sense of personal responsibility to take care of himself and others around him. This statement may well apply to industry at large, but it applies with special force to the urgent rough-and-tumble of daily life on the contract site.

It is customary for the layman to embark upon a discussion involving legal matters with a good deal of trepidation. And rightly so; for while we may be excused if we occasionally mislead ourselves, it is unkind to mislead others under a guise of erudition. Let it be said, then, that the following observations are not authoritative and do not necessarily reflect the opinions of my Company.

Despite occasional twinges of doubt, we are indeed fortunate in having an exceedingly comprehensive code for industrial safety in the shape of the Factories Acts. As a code of practice the Acts and their subsidiary regulations and orders provide an all-embracing guide to safety in industry, as well as a useful standard of reference between purchaser and supplier. As Acts of Parliament they also carry, of course, the persuasive authority of the law.

Contractors working on a factory premises such as a gasworks are subject to the Factories Acts, and when they are engaged upon any of the recognised dangerous trades on those premises, they are also subject to the special regulations affecting those trades. These regulations are provided for by Section 60 of the Factories Act, 1937, and include, among others, the Building (Safety, Health and Welfare) Regulations, 1948; the Electricity Regulations, 1908 and 1944, and the Woodworking Machinery Regulations, 1922, 1927 and 1945.

So far, no special regulations have been made for works of engineering construction, although sections 107 and 108 of the principal Act *provide* for works of building and engineering construction. An important fact about all the regulations made under Section 60 is that they may impose duties on the factory occupiers, and also on 'owners, employed persons and other persons.' The effect of this is to create a relationship between the occupier and the contractor so complex that not even a legal expert would care to commit himself to a general opinion. Every case has to be dealt with on its own merits, and the following remarks are intended merely to indicate the broad extent of the related duties.



Pneumatic scutch hammer, developed by the Woodall-Duckham Construction Co., Ltd., to reduce risk of silicosis in the cutting of silica bricks. The water jet forms a slurry at the cutting edge which smothers the fine silica dust. (Woodall-Duckham Construction Co. Ltd.)

Two Conditions

When a contractor undertakes a job of work on a factory, one of two conditions may exist:

(a) The contractor may be engaged to carry out certain operations which are a part of the normal processes carried on in the factory.

(b) The contractor may be engaged to perform some kind of work which has nothing to do with the processes of the factory.

Situation (a) would occur where a

contractor is supplying temporary labour to replace men who are absent on holiday. In this case the factory owner (or occupier) would probably be primarily responsible for the safety of the contractor's workmen.

A common example of condition (b) is where a contractor is constructing a new building on a factory premises. The contractor is then described, somewhat oddly, as a 'notional occupier,' and he is thereby made immediately responsible for his own workmen under the Building Regulations. At the same time the actual occupier has to make sure that his factory is as safe for the contractor's employees as it is for his own. This means, in practice, that safe means of access must be provided wherever the contractor's men are obliged to move about the factory premises in the course of their work.

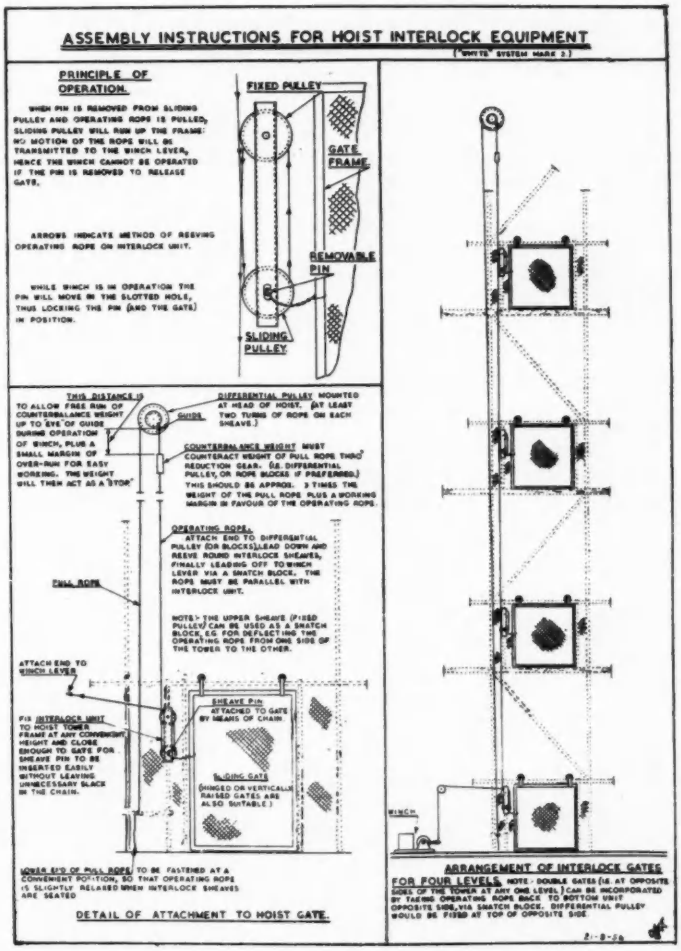
Two Occupiers

It follows from these remarks that whenever a building operation is being carried out on a factory premises there will be two occupiers, the owner, and the ghostly (but strictly answerable in law) 'notional' occupier. Each will be responsible for the safety of his own employees, and in addition each may owe some duty of care towards the employees of the other.

Furthermore, if a contractor's employee is injured on a factory, it is the contractor's duty to report the accident to the occupier, who must then report it to the Factory Inspector in the usual way. (F.A. 1937, Section 64.)

Occupiers and contractors are also linked in common law duty. It appears that the factory owner must ensure that all contractors working under his control observe their obligations towards their own employees, even when they are not subject to his immediate direction. This, by the way, is an example of an occasion where the safety officer performs a useful service in promoting adequate co-operation between the two parties, so as to ensure that their respective duties are effectively discharged.

Despite the scale of the building industry in our national life, it is a curious fact that the word 'building' has no statutory definition, although a building operation is fully defined. In an attempt to make up for this deficiency, however, the legislators have provided us with a spectacular list of structures which are not considered to be buildings. This list includes wharves, sea defence works, reservoirs, viaducts, sewers, filter beds and gasholders, and just in case these items seem a little too obvious, let us pause and remember that in the past the courts have declared to be buildings such unlikely objects as a tall chimney, a wall, and a tunnel under a road.


ASSEMBLY INSTRUCTIONS FOR HOIST INTERLOCK EQUIPMENT
("WHYTE" SYSTEM MARK 2)
PRINCIPLE OF OPERATION.
WHEN PIN IS REMOVED FROM SLIDING PULLEY AND OPERATING ROPE IS PULLED, SLIDING PULLEY WILL RUN UP THE FRAME: NO MOTION OF THE ROPE WILL BE TRANSMITTED TO THE WINCH LEVER, HENCE THE WINCH CANNOT BE OPERATED IF THE PIN IS REMOVED TO RELEASE GATE.
ARROWS INDICATE METHOD OF REEVING OPERATING ROPE ON INTERLOCK UNIT.
WHILE WINCH IS IN OPERATION THE PIN WILL MOVE IN THE SLOTTED HOLE, THUS LOCKING THE PIN (AND THE GATE) IN POSITION.
FIXED PULLEY
GATE FRAME
REMOVABLE PIN
SLIDING PULLEY
THIS DISTANCE IS TO ALLOW FREE RUN OF COUNTERBALANCE WEIGHT UP TO EYE OF GUIDE DURING OPERATION OF WINCH, PLUS A SMALL MARGIN OF OVER-RUN FOR EASY WORKING. THE WEIGHT WILL THEN ACT AS A "STOP"
GUIDE
DIFFERENTIAL PULLEY MOUNTED AT HEAD OF HOIST. (AT LEAST TWO TURNS OF ROPE ON EACH SHEAVE.)
COUNTERBALANCE WEIGHT MUST COUNTERACT WEIGHT OF PULL ROPE THRU' REDUCTION GEAR. (I.E. DIFFERENTIAL PULLEY, OR ROPE BLOCKS IF PREFERRED.) THIS SHOULD BE APPROX. 3 TIMES THE WEIGHT OF THE PULL ROPE PLUS A WORKING MARGIN IN FAVOUR OF THE OPERATING ROPE.
OPERATING ROPE. ATTACH END TO DIFFERENTIAL PULLEY (OR BLOCKS) LEAD DOWN AND REEVE ROUND INTERLOCK SHEAVES, FINALLY LEADING OFF TO WINCH LEVER VIA A SNATCH BLOCK. THE ROPE MUST BE PARALLEL WITH INTERLOCK UNIT.
PULL ROPE
NOTE:- THE UPPER SHEAVE (FIXED PULLEY) CAN BE USED AS A SNATCH BLOCK, E.G. FOR DEFLECTING THE OPERATING ROPE FROM ONE SIDE OF THE TOWER TO THE OTHER.
ATTACH END TO WINCH LEVER
FIX INTERLOCK UNIT TO HOIST TOWER FRAME AT ANY CONVENIENT HEIGHT AND CLOSE ENOUGH TO GATE FOR SHEAVE PIN TO BE INSERTED EASILY WITHOUT LEAVING UNNECESSARY SLACK IN THE CHAIN.
SHEAVE PIN ATTACHED TO GATE BY MEANS OF CHAIN
SLIDING GATE (HINGED OR VERTICALLY RAISED GATES ARE ALSO SUITABLE.)
WINCH
ARRANGEMENT OF INTERLOCK GATES FOR FOUR LEVELS. NOTE - DOUBLE GATES (IE. AT OPPOSITE SIDES OF THE TOWER AT ANY ONE LEVEL) CAN BE INCORPORATED BY TAKING OPERATING ROPE BACK TO BOTTOM UNIT OPPOSITE SIDE, VIA SNATCH BLOCK. DIFFERENTIAL PULLEY WOULD BE FIXED AT TOP OF OPPOSITE SIDE.
WHOLE END OF PULL ROPE TO BE FASTENED AT A CONVENIENT POSITION, SO THAT OPERATING ROPE IS SLIGHTLY RELAXED WHEN INTERLOCK SHEAVES ARE SEATED
DETAIL OF ATTACHMENT TO HOIST GATE.

The Whyte interlock equipment applied to builders' hoists to ensure that the hoist cannot be moved when any of the gates are open. (Woodall-Duckham Construction Co. Ltd.)

Clearly there must be many occasions when the contractor is at a loss to know whether the work he is carrying out is or is not legally a building operation, and the only safe rule is: If in doubt, apply the building regulations. After all, the regulations provide an excellent guide to a safe standard of work—in fact they are intended to be regarded as a *minimum* standard. As a matter of hard economics, it is not, I suggest, a question of how many precautions we can afford to adopt, but how many we can afford to ignore.

Despite the great advances in safety technique during the past decade or so, there remains a widespread and—to some extent—understandable feeling among some contractors that these special and exacting legal obligations are invidious, and more likely to add to their burdens rather than help to ease them. This impression usually derives from the apparent incompatibility of safety precautions and production, not only from the economic point of view, but also having regard to the possibility of accident prevention policies tending to hamper rate of output.

The economics of safety in the building industry have been very thoroughly ventilated recently, and some of the conclusions are surprising. Although there is no overall figure for the cost of accidents in this industry, a few firms have carried out investigations into their own accident costs. One particular survey was published by the London Master Builders' Association, on the occasion of a special half-day conference on accidents in the building industry. This survey covered a building site in the Midlands where an average of a

hundred men were employed for 12 months. During this period six 'notifiable' accidents occurred which cost the firm £85 13s. 8d. and there were 408 'minor' accidents, the *immediate* cost of which amounted to £785 8s. These figures exclude the cost of insurance, investigations and litigation. At the same conference it was pointed out that for every notifiable accident in the building industry there are about 40 accidents which are not notifiable, but cost money in terms of loss of time, care of the injured, loss of production, damage to materials and equipment, administration charges, and so on.

Compensation

In addition, vast sums of money are paid out every year in compensation and litigation, all of which, one would think, could be better spent in developing improved safety techniques and training. Unfortunately it is not simply a question of a total shift from one alternative to another.

Contractors are nearly always engaged upon inherently dangerous operations. Of the 'dangers' already indicated, the most serious is the complexity of hazards associated with the ever-changing conditions on the site, and while some of the most expensive remedies have proved to be abortive, other methods, far less elaborate, have been astonishingly effective. It is generally true, therefore, that a sound accident prevention policy must inevitably cost money, although the return, as with any other form of investment, will depend upon how wisely the money is used.

Dramatic Response

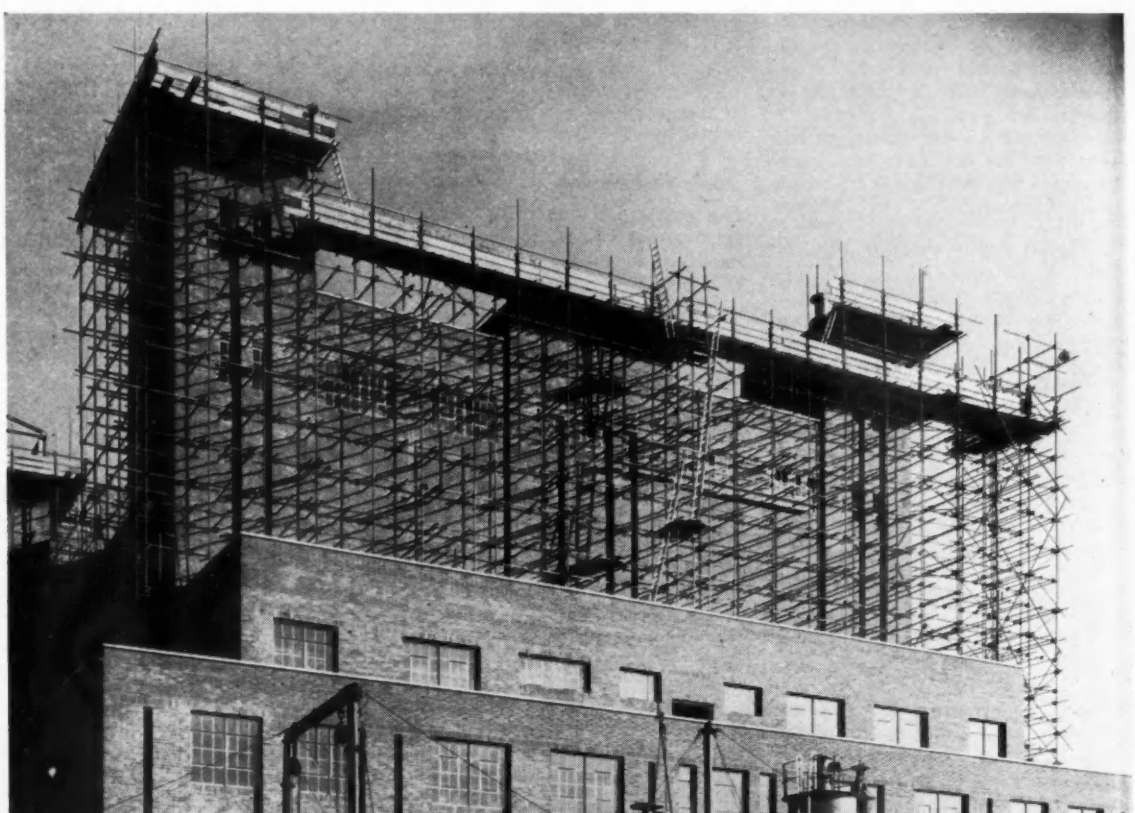
It is, I think, in the domain of constructional engineering work that accident prevention systems are demonstrated most readily as aids to efficiency. The effects of shortcomings in control and increasingly slipshod methods of working are always reflected in the contract's record of accidents. Conversely, a job which has had a thorough safety overhaul will respond dramatically. With better appliances, safer methods of access and tidier surroundings, the whole tone of the job improves. Inevitably this is followed by better relations and improved production. This is the second item in the economics of safety, and one which is becoming more widely recognised every day.

The third item is, perhaps, a rather more sentimental one. There was a time when human lives were reckoned as part of the cost of any large engineering enterprise. As the first shovel-full of earth was dug, it was known that before the job was finished, a certain number of men would die.

Today, mercifully, we do not accept very serious accidents as an inevitable feature of contract work, but we do know that accidents are almost certain to occur.

Future Probability

Perhaps we are preparing to start a job carrying an average of 100 men. We may look at our current accident frequency rates, and if we see a figure of (say) two, we will know that in the next 12 months we can expect between five and six accidents severe enough to keep the victim away from work.



Woodall-Duckham Construction Co. Ltd.

A retort house under construction showing the Woodall-Duckham standard arrangement of scaffolding with guards, ladders, handrails, etc.

Some might accept that as a reasonable figure; there are many who will not. They know that statistics do not decide the future level of safety on a site. The figures merely indicate what has gone before—and what will probably happen again unless steps are taken to improve matters.

There are today, all over the country, firms of contractors who recognise not only that such steps are expedient, but *also* that in the interests of humanity they should not only accept their legal obligations in good faith, but occasionally go far beyond them.

What are the Contractors Doing ?

So far, I have been dealing with the problem which the responsible contractor has to face. It is a problem very different from—if no less perplexing than—that confronting the factory occupier. Its only link is a fundamental one, since the entire subject of accident prevention ultimately reduces to little more than a study of ignorance, negligence and folly. For these reasons, the established safety techniques can be applied to contract work only to a very limited extent, and it has been necessary for the contracting industries to develop their own methods of accident study and accident prevention.

One of the biggest influences in this direction has been the formation of the various industrial groups under the ægis of the Royal Society for the Prevention of Accidents. These groups are composed of representatives of local firms and other organisations interested in occupational accident prevention—trades unions, educational establishments, and others. Altogether there are about 50 groups operating in industrial areas throughout the country, two of which are directly concerned with building and constructional work. These are the London Building and Engineering Contractors' Accident Prevention Group, and the Birmingham and District Industrial Safety Group.

The first of these groups, of which my Company is one of the founder members, was inaugurated in 1953, with an attendance of 41—which is now trebled. Among its activities the group runs apprentices' safety training courses, and is now undertaking the formation of a full-scale accident prevention training centre for foremen and others engaged in the building and constructional engineering industries. The Group has also made preparations for the publication of a 'safety desk diary' for site offices.

The Birmingham and District Group established their Industrial Safety Training Centre six years ago. This Centre provides a variety of courses, and specialised training is available for builders' and contractors' foremen and safety advisors in the building industry, and there are further courses dealing with the use and maintenance of lifting machines.

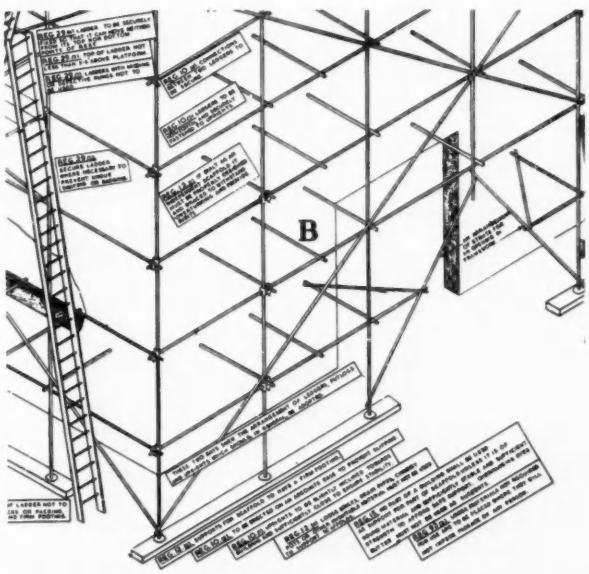
Invaluable Contributions

Other organisations, not directly concerned with accident prevention, are making invaluable contributions towards the progress of safety. Among these I would mention the various employers' associations—the Federation of Civil Engineering Contractors, the National Federation of Building Trades Employers and the local affiliated organisations, such as the London Master Builders' Association—all of whom are actively engaged in running training courses, carrying out surveys of accidents in industry, organising safety campaigns, etc.—also the L.C.C. Brixton School of Building who are giving lecture courses for junior safety officers, and the National Federation of Building Trades Operatives, with their energetic and practical support of the safety movement.

The post-war reconstruction programme has brought about many changes in building and constructional engineering techniques—these, not surprisingly, have produced new hazards, but also, fortunately, new developments in accident prevention methods.

Portable access equipment is now frequently used in factories for the repair and maintenance of buildings. A variety of types of mechanically elevated staging have appeared in recent years; also lightweight transportable towers which can be built up rapidly from prefabricated frames. One firm in France has even tried out a staging supported by a hydrogen-filled balloon—a device which, at least, may discourage smoking on the job.

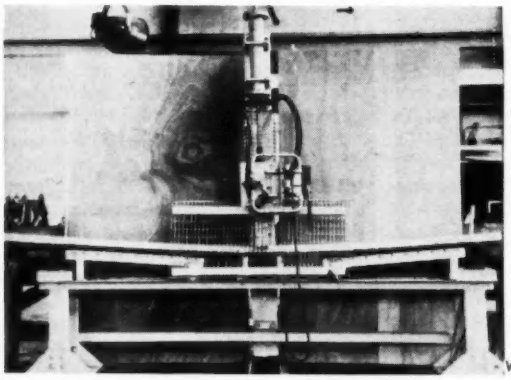
Temporary electric lighting and portable electric tools on sites have always been a source of danger, but now this can largely be overcome by means of monitored earth-leakage protection and the use of transformer sets with low voltage output.



A section of the instruction sheet for the erection of scaffolding and hoist towers, displayed on all W-D. sites. (Woodall-Duckham Construction Co. Ltd.)

Dramatic and Terrifying

New types of power-operated digging, transporting and lifting equipment are helping to reduce accidents caused by faulty manhandling, but in their place we now have the more serious, if less frequent, 'machine made' injuries, or even the dramatic and terrifying incidents which occur when very big pieces of equipment suddenly collapse in a welter of twisted metal and debris. The materials of lifting tackle are also undergoing interesting stages of improvement. Since the war, more electrically-welded steel chain has been used, and mild steel chain made to B.S.590 has proved to be highly satisfactory. From the building con-



A pneumatic device, developed by Woodall - Duckham Construction Co., Ltd., for applying a deflection to scaffold boards in accordance with B.S.S. 2482: 1954.

Woodall-Duckham Construction Co. Ltd

tractor's point of view it has the great advantage of not requiring periodic heat treatment. A British Standard for higher tensile steel chain is also in the course of preparation. And here a new danger arises, in the possibility of ordinary wrought iron chains getting mixed with the higher tensile articles and being subjected to the greater permissible working load of the latter.

Safety devices of all types and purposes have been conceived and developed by so many firms of contractors that it would be impossible to give an adequate list in the space at my disposal. I have therefore reserved—with understandable satisfaction—the right to name a few which have been produced by my own Company in recent years.

The large wall-sheet—'Notes on the Erection of Scaffolding,' illustrating a putlog scaffold with labels indicating the relevant regulations—is widely known and has been distributed to hundreds of firms and organisations at home and overseas. All sites are provided with large instructions cards dealing with the safe use of double-sling chains and scaffold boards. Other display cards show where protective equipment can be obtained. The Company's gate interlock system is used on all goods hoists during construction.

A pneumatic brick-cutting hammer has recently been developed: This is equipped with a dust suppressing device employing a novel principle. Improved safety features have been made in several types of lifting equipment—notably shackles and gin wheels.

Current for portable electric hand tools and lighting equipment is supplied from special reduced-voltage distribution equipment designed by the electrical staff.

Close attention has been paid to the need for ensuring that sites are provided with all the necessary Factories Acts forms, registers, etc., and at the commencement of each contract a wallet containing these documents is sent to the site. The wallet bears a label stating that it is to be hung in a prominent position where it will be readily available for inspection. During the course of the contract, and at intervals of not more than two months, the registers are sent to head office for inspection, and the attention of the site staff is then called to any mistakes or omissions that may be discovered.

Special attention is paid to the welfare and safety of the Company's apprentices, and individual reference is made to these aspects of the boys' progress when the periodic training reports are sent to head office.

Finally, the Company enjoys the benefits of a large and well-equipped Plant Department, where the erection plant, tools and tackle receive all necessary attention. In addition to the devices for testing hoists and lifting appliances, there is an ingenious pneumatically-assisted machine for testing scaffold boards.

The Remedy

When we look at the accident records for the building and constructional engineering industries, we have to admit that the figures are not very impressive, and unfortunately there are still no very evident signs of improvement.

In his report for the year 1956, H.M. Chief Inspector of Factories said:

> 'Accident prevention organisation in the building trade is also gaining momentum, although somewhat slowly during the year under review. It is hoped that subsequent developments will accelerate progress.'

Now why is it that, with so much safety activity in the contracting industries, the results are so disappointing? There are, I suggest, two answers: Lack of interest on the part of a large number of contractors, and lack of sufficient co-operation from the workers. Where the employer is at fault there is, of course, no question of co-operation and therefore no systematic safety. But all too frequently a positive safety-minded attitude of the management is frustrated to the point of extinction by the apathy of the employees. Normally, conditions fluctuate somewhere between these extremes, and just occasionally the better elements from both sides combine and produce a state of harmony. On the other hand it has been demonstrated by social research workers that a crop of accidents frequently precedes a state of industrial strife, even where there is no apparent connection.

I have suggested two possible answers, each of which indicates a remedy. Safety workers have established the methods of accident prevention; it is now mainly a matter of getting more people to participate.

More contractors—and particularly the smaller concerns—must be persuaded to give their support to the safety movement. I am sure there is scope for a great deal of planned effort in this direction.

And we must continue to train our workmen, to stimulate their interest and induce a responsible attitude to the business of keeping themselves and their fellow employees out of trouble.

This is a tiny part of the evolution of our industrial cosmos. We will be pardoned if we prefer to adopt the principle of 'slow but sure' rather than the jungle law of 'survival of the fittest.'

The author would like to thank Woodall-Duckham Construction Co., Ltd., for kindly giving him permission to publish this article.

WIDE RANGE OF PROTECTIVE CLOTHING OFFERED

AN exceptionally comprehensive range of protective clothing for factory and outdoor workers is now being marketed by the newly-formed protective clothing division of Scaffolding (Great Britain) Ltd. It includes boiler suits, overalls, gloves, aprons, safety footwear, helmets and goggles, while for the outdoor worker there are rubber boots, donkey jackets, waterproof clothing and duffle coats.

A unique feature of the SGB service is that distribution of all these products is made from stocks held at the Company's 36 branches throughout the country.

Explosion Hazards

by

A. R. MYHILL, *F.R.I.C., M.Inst.Gas E.*

THE term 'explosion' is usually taken to mean a sudden and violent increase in pressure taking place outwardly against the inner walls of an enclosed vessel or chamber, and generally refers to cases where there is danger of disruption, with consequent hazards to life and property. So far as gasworks practice is concerned, explosions are generally the result of extremely rapid combustion brought about by the accidental ignition of a combustible constituent in an oxidising atmosphere, as, for example, coal gas and air. The combustible component may be solid, liquid or gas, but in all cases two essential conditions must be prevalent, *viz.*, intimacy of mixture and occurrence of the constituents in proportions lying within well defined ratios of combustible to oxidant, known as the upper and lower inflammability limits. As a general rule, those mixtures which have a wide difference between upper and lower inflammability limits will be more liable to explode than those with only small differences in limits. Thus, hydrogen/air mixtures range from 4% H_2 to 74% H_2 as the limits, as compared with petrol/air limits of 1.4% petrol vapour up to 6%. There is therefore a greater risk of explosion when dealing with hydrogen than with petrol. The following table shows typical inflammability limits of various gases and vapours in air:

	Lower limit (percentage of combustible)	Upper limit (percentage of combustible)
Benzene	1.4	7
Blast furnace gas ...	35	74
Butane	1.9	8.5
Petrol	1.4	6
Carbon monoxide ...	13	74
Methane	5	15
Coal gas	5	30
Blue water gas ...	7	60
Hydrogen	4	74

Different mixtures have different flame velocities. A high flame velocity greatly increases the likelihood of accidental ignition, and is generally associated with greater damage, since this means rapid propagation of a flame from the seat of origin to more remote localities, and may cause secondary explosions. Hydrogen and blue water gas/air mixtures have much higher flame velocities than hydrocarbon/air mixtures. Thus, mixtures of blue water gas and air are more liable to explode than mixtures of coal gas and air. A practical example of this may occur in steamed vertical retort practice where at a certain stage in the process steaming of coke produces water gas. If this is not at the time or place accompanied by coal gas, and air is accidentally drawn into the retort ironwork chambers, a dangerously explosive mixture may be the result.

Explosions involving liquids may be divided into two classes: In some cases the liquid may have a low boiling-point and its vapour may be taken up in explosive ratios in air. This, of course, is really a special case of an air/gas mixture and behaves as such when ignited. The other case relates to high-boiling-point liquids such as the heavier oil distillates which have high open flash points and are not normally regarded as dangerous in bulk form. Nevertheless, dispersions of such liquids in extremely finely divided form in suspension in air can constitute highly explosive mixtures. Dispersions of this nature can be formed where the oil is atomised from a jet, or where condensation takes place as a cloud, in a relatively large vessel. Serious explosions of this nature have occurred, a classic example being the case of the m.v. Reina del Pacifico in 1946 which suffered a crank-case explosion resulting in the loss of 28 lives. The explosive medium was a finely dispersed mist formed by volatilisation and condensation of lubricating oil, ignited by an overheated cylinder piston.

Solids in the form of fine dust in suspension in air can be potent sources of explosion equally with gas or liquid/air mixtures. Examples are explosions of coal dust in mines and of explosions in certain industries producing finely ground carbonaceous material, as, for instance, farinaceous foodstuffs, etc. Incidentally, a matter which will have to be taken into consideration in gas-making in the future, will be means of protection from explosion of stocks of fine coal dust prepared for use in fluidised gasworks processes.

With solid carbonaceous particles, fineness of division is an essential prerequisite of explosion. Particles will often be of a wide range of sizes, the larger and heavier gradings falling out and leaving the smaller material in suspension, especially in ducts and chambers where the atmosphere is in motion. There may, therefore, be localised positions in works plants where explosive conditions prevail, while in other parts the atmosphere may be harmless. Such a state of affairs may constitute an added danger, since a comparatively harmless explosion in a 'pocket' or localised spot may produce movements which disturb the concentrations of particles in another part of the system and thus lead to larger explosions. This effect was brought into prominence during investigations into the effects of bomb damage in World War II.

Danger of Powders

It was found that certain groups of factories and warehouses suffered much greater damage than would have been expected from the type and size of the explosive weapons known to have been used. Buildings exhibiting this peculiarity were those in which combustible material was stored in fine-powder form. Such material included sugar, starch, cocoa, wood-dust and finely divided metals used for paints and sprays, such as aluminium, magnesium and zinc. When the primary explosion of the weapon occurred, its disruptive effect caused the containers or heaps of material to disintegrate, with the result that large amounts of fine powder were dispersed through the buildings and plant in intimate association with air, thus producing explosive mixtures which, in some cases, had potentialities of damage greater than those of the original explosion. Moreover, such secondary explosions can be self-propagating, and the flames produced may travel through ducts or open doors to locations far removed from the source. Such effects have frequently been observed in colliery explosions started by fire-damp and transmitted by coal-dust.

Precautions against explosion dangers may be roughly classed as those in which steps are taken to avoid the explosion altogether, and those in which the effects of an explosion which has already taken place can be minimised or rendered harmless.

Those in the first category include

means which will avoid the accumulation of an explosive mixture in a confined chamber, as, for instance, the admission of air into a gas-filled space by accidental indrawal through leaks, or access to an air supply under pressure. In some cases, the presence of an explosive mixture may be essential to a process, in which case the necessary precautions constitute means for avoiding ignition.

Some of the precautions necessary are fairly obvious even to those with little or no technical knowledge, as, for example, the prohibition of all open flames, electric sparking, and smoking in potentially dangerous locations. Such areas include buildings where large-scale gas-fitting is being carried out, as for furnaces and gasworks plant, petrol pump stations, liquid storage tanks and any place where volatile inflammable liquid is stored or used. Ignition may be avoided by the use of tools which cannot strike sparks, and special materials can be obtained for such operations as hammering and chipping. Lids of storage tanks, including road tankers, containing inflammable liquids must not be forced open with hard tools. Special polythene or rubber mallets are available for this purpose. Non-sparking tools made of bronze or other special alloy are used for breaking up spent oxide when removing the contents of purifier boxes.

Electric sources of ignition must not be forgotten, and open-element electric radiators strictly prohibited in dangerous areas. In order to prevent sparking or arcing-over, all metal work should be effectively earthed to avoid not only effects of accidental power leakage but also to prevent accumulation of static charges from induction or other sources. Static charges may be produced in rubber hose conveying petrol or benzole, as to or from tankers and storage wells. The tank and armouring should be well earthed, the method including effective electric bonding at joints in pipe lines, connections to pumps, tanks, etc.

Electrostatic dust, tar, or mist precipitators should never be used in vessels known to contain an explosive atmosphere. Although such apparatus should not normally produce any sparks, the possibility is always present from time to time if minor faults should occur. In normal gasworks tar precipitators, the atmosphere, being substantially air-free is non-explosive. Exceptional conditions could, however, be imagined, where sufficient air might be drawn in through a leak at the inlet to the apparatus, by suction from the exhauster, to form an explosive mixture. The likelihood of an explosion due to this cause is extremely remote. The writer has never heard of a case where it has happened. It is possible to guard against it by various methods. One suggested plan is to use a device which is capable of detecting oxygen in the gas stream prior to the precipitator, and the automatic release of an inert gas from a cylinder into the apparatus to dilute the gas mixtures to concentrations below the explosive limits.

Such a device needs to be very rapid in action, and must respond well in advance of the gas-flow.

It is also possible to fit an automatic explosion suppressor (described below) to prevent damage in case an explosion should be started.

The use of inert gases (nitrogen, carbon dioxide, etc.) for reducing the concentrations of explosive mixtures below the inflammability limits is practised extensively. Fine dispersions of solid or liquid particles are also employed for the same purpose. In mines, stone dust is used for damping out explosions travelling along ducts, while in factories producing carbonaceous powders it is often the practice to store paper packets of inert dust

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Fig. 1.

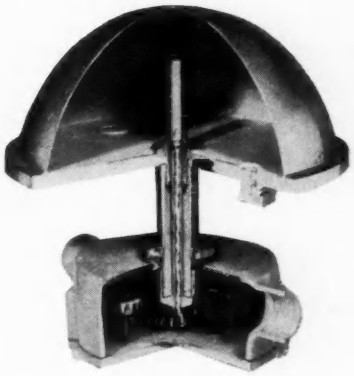

Fig. 2.

in the vicinity of stocks of inflammable powders, so that, should an explosion occur, the packets become disrupted and the contents scattered. Danger of formation and ignition of gas-air mixtures in large vessels such as gasholders, purifiers and mains, has now been reduced almost completely by adopting the now-standardised procedure of purging with the Harrison-type purging machine supplying inert combustion products, or by using CO_2 or nitrogen from cylinders. Purging in this manner should always be carried out when putting large plant into, or out of, commission. In exceptional cases, as when filling a new main with gas, it may be permissible to displace the air directly by gas, allowing the air to escape through tall stand pipes discharging into the atmosphere at a height of, say, 40 ft. above ground level, the outlets of the pipes being, of course, well out of the way of sources of ignition. Even so, a flame trap should be used in or on each outlet pipe. This acts on the same principle as the gauze in a miner's safety lamp which, by rapidly conducting from the gas any heat which might have developed through accidental ignition, prevents passage of flame to the explosive mixture.

Fig. 1 is an enlarged view of the Amal flame trap, showing the arrangement of the gauge or cells of conducting metal.

In the case of an explosion, there is a definite time-lag between the ignition of the mixture and the development of maximum pressure. If the explosion can be detected and suppressed at a very early stage, the development of dangerous pressures can be avoided and the explosion will be damped out.

A system of operating this principle consists of an explosion detector which, through an electric power unit, causes a blanket of finely divided suppressing liquid to be dispersed into the explosion space. The dispersal can be made to be much more rapid than the rate of travel of the explosion front. Fig. 2 shows a hemispherical suppressor made by Gravinor Manufacturing Co., Ltd., Gosport, Hants., which can be used for the suppression of an explosion of either gas, vapour, mist, or dust.

The suppressant liquid is confined in a hemispherical silver or copper container, which is ruptured by firing an internally mounted detonator actuated by a relay system controlled from a pressure-sensitive diaphragm inside the vessel to be protected.

A special high-speed isolation valve has been developed for use in conjunction with this system. This prevents the travel of flame or burning material from one part of the works plant to another, and thereby minimises the chance of secondary explosions.

Polyclens Aids Safety with Cleanliness

ANY part of a gasworks where tar is handled, is likely to be a dirty place and the vessels containing it and the pipelines transporting it need periodical cleaning out, since the heavier fractions of crude tar are likely to settle out in cold weather. Some kind of cleaning agent is necessary.

Such cleaning agents generally contain volatile hydrocarbon solvents and are based on solvent naphthas. Since such solvents are inflammable, great care must be taken in their use especially in enclosed spaces. Any danger from inflammable vapour concentrations in enclosed vessels may be obviated by the use of some cleansing agent which depends for its action on the formation of a water soluble emulsion between the tar and the active constituent of the cleanser.

Such a cleansing agent may be found in 'Polyclens' which has recently come into prominence because of its success in the cleaning of a variety of pieces of gasworks' plant likely to be fouled by tar and other dirt.

Polyclens, though acting in a similar way to a detergent is more accurately described as a 'surface agent,' since it combines with any superficial tar, oils, grease or wax on a surface to be cleaned to form a water soluble emulsion. The emulsion can then be effectively washed off with water without resort to hydrocarbon solvents. Because of its non-inflammability Polyclens may be used in places where other cleaners containing solvent naphthas would be dangerous, such as off-take pipes in retort houses.

The emulsifying operation with Polyclens may be reversed and tar emulsions may be broken down. The emulsion obtained in the cleaning of the off-take pipes may be subsequently broken down and if it has been run into a settling tank, the different tar fractions and the free carbon may be recovered for analysis if necessary. The breaking down of tar emulsions is another very useful property of Polyclens and can be applied to emulsions which have been formed in storage tanks and waterless gasholders, and are difficult to dispose of. The breaking down of coal tar emulsions is more often successful than water gas tar emulsions.

Polyclens may be used for breaking down nitrogenous gums deposited on valve seatings, thermostats or inside pipes and mains. It can be useful for the cleaning of plant and machinery

being stripped for repairs. In the past it was necessary to wash engine parts in paraffin or tar pump components in some type of inflammable solvent.

If Polyclens is used, such components may be put into a tank of suitable size containing concentrated Polyclens and allowed to stay immersed long enough for the emulsifying action to take place. The parts after washing with water will be perfectly clean.

A further advantage to be gained from this use of Polyclens is that, since it has no harmful effects on the skin, anyone undertaking the cleaning of machinery parts runs no risk of skin trouble from the drying effects of a hydrocarbon solvent or the possible danger from tar dermatitis at some future date.

Polyclens has proved successful for the preparation of surfaces for painting. Such surfaces may be cleaned by swabbing off with Polyclens followed by a wash down with water. Since Polyclens is perfectly neutral, and supersedes caustic cleaners, much expense incurred on preparation and the undercoating can be saved. It is particularly useful for the cleansing of paint brushes, stencils and screens, which after immersing in Polyclens for a few moments are quickly cleaned by rising in water.

New Booklets on Industrial Safety, Health, Welfare

TWO booklets, the first of a new series on industrial safety, health and welfare subjects, have been published recently on behalf of the Ministry of Labour and National Service.

Every year, accidents at work cause an immense loss of production to industry, and untold human suffering. It is hoped that the new booklets will help to reduce the number of accidents.

They are not intended only for the information of management. It is believed that they will be found suitable for a wider circulation among workers at all levels. So far as the subjects permit they are written in non-technical language and are fully illustrated. The Central Office of Information has collaborated with the Ministry in presenting the booklets in an attractive form.

The advice in the booklets is based on the experience of H.M. factory inspectors and where appropriate other Government departments are collaborating with the Ministry and advice and assistance is being obtained from expert bodies and representatives of industry.

The first in this new series is 'Lifting and Carrying'—Safety Health and Welfare, New Series, No. 1, published by H.M. Stationery Office, price 1s.—and its advice is of almost universal application, not only throughout industry, but also to every man, woman and child in their daily lives.

The second book in the new series will deal with canteens and messrooms for small factories. It is in course of preparation and will be published shortly.

Number 3 in the Series, 'Safety Devices for Hand and Foot Operated Presses,' also recently published, is more specialised than the other two. It is often too readily assumed, the booklet says, that because these presses are only powered by the effort exerted by an operator's hand or foot, they are not dangerous.

Statistics show, however, that in one year 691 accidents involving disablement for more than three days occurred on hand presses, and 231 on foot presses.

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. . . if he can't help the man down the hole?

If a man working on live gas is overcome, it is essential for the safety man to be able to haul him into fresh air without also exposing himself to gas.

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Fig. 101

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FIRE HAZARDS OF GAS INDUSTRY PREMISES

Which Extinguishers to Use

THIS article sets out to show (a) where risks occur on premises occupied by gas boards; (b) what type of risks occur; (c) the advantages of the modern extinguishers, and how they should be used.

For the purpose of specifying equipment, fire-risks may be divided into three main groups.

Class A risks: Carbonaceous substances such as timber, paper, textiles, etc.

Class B risks: Inflammable liquids.

Class C risks: Electrical equipment.

Class A risks occur principally in the tradesmen's shops, timber stores, offices, and showrooms. The majority of fires fall into this category.

Perpetual Risks

Class B risks are most serious in the works themselves. The recovery and storage of benzene, toluol, naphtha, tar, etc., constitutes a perpetual fire risk, for all these liquids are highly inflammable. Class B risks are also present in laboratories, oil stores, and garages, and in canteen kitchens where there are deep-fat frying ranges.

Class C risks are mainly in offices and showrooms.

'Portable extinguishers are the minimum equipment for fire-fighting. They should be provided in adequate numbers throughout the premises and in types appropriate to the various risks present.' This statement was made in an issue of the Fire Protection Association's journal last year. It sounds axiomatic enough, but the advice is seldom strictly followed—which accounts for most of the extensive fire damage that occurs year after year.

The statement does, however, miss out a vital point: Little can be gained by providing extinguishers in 'adequate numbers' if they are antiquated and unreliable, and many such machines are in use today.

It is impossible to over-emphasise the importance of installing a standardised range of extinguishers; only in this way can speedy action with fire-fighting equipment be achieved. On most premises, of course, little time can be spared for training in the use of fire-fighting equipment.

Extinguishers should, therefore, be of such a design that the methods of operation and suitability for a particular risk are obvious. In addition, to avoid confusion, there should be the minimum number of different types of extinguisher.

Types of extinguisher which can be recommended for these risks include:

Class A risks (carbonaceous substances): Pressure-operated plain water extinguishers should be provided capable of discharging a powerful jet or spray of water at high pressure. They should be installed at all alarm points, and at principal entrances and exits of offices, showrooms, demonstration theatres, wood-working shops, etc. They should be either on wall hooks or on floor stands so that they are not likely to be moved about or obstructed. Spare pressure-charges should be kept in a wall clip nearby.

Class B and C risks: In 1952 an air foam extinguisher for use on inflammable liquid fires, and obviating all the disadvantages of the chemical foam machine, was perfected, and approved by the Fire Offices' Committee. This represented a considerable advance in fire-fighting technique.

Research

Research, however, does not stand still, and the latest development in first-aid fire-fighting equipment is a revolutionary kind of dry powder extinguisher designed for use on class B and class C fires, and mixed B and C risks. This is marketed by the firm Nu-Swift Ltd. which produced the air foam extinguisher, and it is claimed to be the most effective extinguisher for inflammable liquid and electrical fires so far developed. One model in a standard test has proved capable of putting out a 250 sq. ft. petrol fire in its discharge time of 28 seconds.

How does dry powder extinguish a fire? A flame is a moving front of combustion and its continued existence depends on the regular progression of the reaction from each burning molecule to the next. By reducing the latent heat or oxygen or by interposing negative catalysts, this process can be halted.

The extinguishing effect of dry powder is produced by projecting into the flames a spray of fine particles. By a combination of their chemical and physical properties, as well as the degree of their dispersion, these particles halt the innumerable chain reactions which form the flames.

Dry powder can therefore be said to isolate or interrupt the combination of oxygen with the combustible element, although physically, like foam, the powder may appear to blanket the fire.

Perhaps the most noteworthy feature of the dry powder is its heat-defying properties: Sheltering behind its spray the fire-fighter can get within really effective range of the fire, something that has previously been difficult, particularly in tackling inflammable liquid fires.

In addition, the powder is non-toxic, non-corrosive, non-abrasive and a non-conductor of electricity (this last is of considerable importance in dealing with electrical fires).

The new extinguisher is available in two sizes: Model 1604 weighs 10½ lb. and contains 4 lb. of dry powder; Model 1630 (whose standard test is mentioned above) contains 30 lb. of powder, which is expelled in 28 seconds, and its weight, complete with a lightweight trolley, is 59 lb.

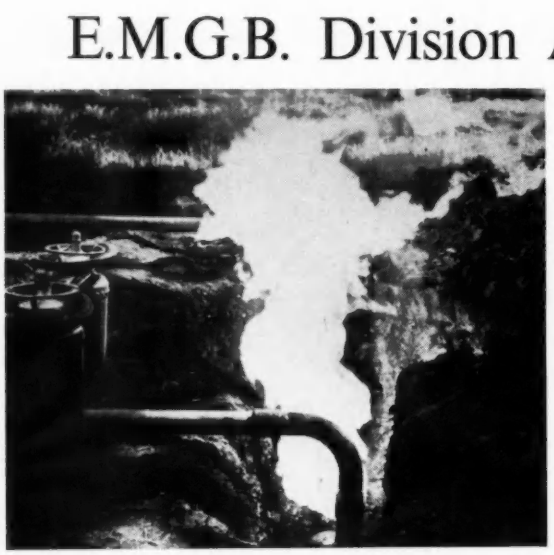
Other advantages of these extinguishers may be noted. They are all operated in the sensible upright position; they are pressure-operated, which cuts out the delay involved in waiting for a chemical reaction to build up pressure.

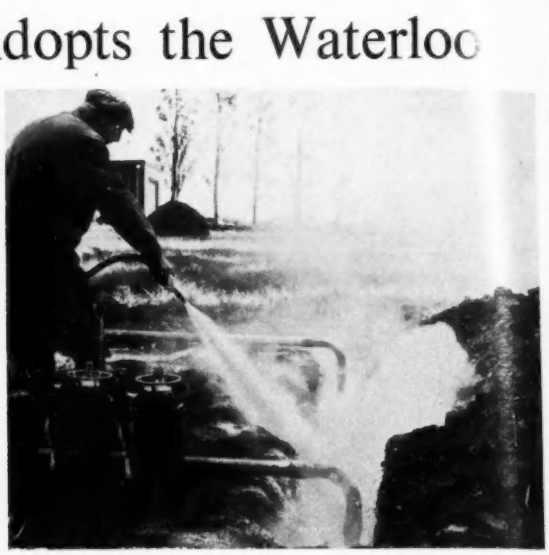
Accidental Discharge

The modern water, air foam and the small dry powder models can all be re-charged and back in action in 30 seconds; and both dry powder models incorporate a tell-tale gauge to provide instant confirmation that the extinguisher is fully charged. No expensive maintenance is necessary for any of the newer models.

If first-aid extinguishers of the right kind, in the right numbers, are installed in the right places, premises will be as safe as it is possible to be from extensive fire-damage.

E.M.G.B. Division Adopts the Waterloo





Left, flames leap into the air as a fractured 6-in.-diameter main is ignited for a demonstration of the Waterloo extinguisher. Right, within seconds the powder from the Waterloo extinguisher has smothered the flames; the fire is out.

ALL distribution emergency vans in the Leicester and Northants Division of the East Midlands Gas Board are being fitted with the new Waterloo CO_2/dry powder fire extinguisher manufactured by Read & Campbell Ltd., of 75, Victoria Street, London, S.W.1. Mains and service layers of the Division recently saw for themselves the effectiveness of this appliance when, at a demonstration at Northampton, they watched a blaze from a 6-in. diameter main dealt with in a few seconds.

The new extinguisher has an outward appearance very much like the conventional models, but instead of the familiar foam liquid it is filled with a pale green powder which has an instantaneous action even against fires caused by ignited gas.

This type of extinguisher, besides speed of action, has two particular advantages over the old soil and water method of dealing with this type of fire: It cuts out damage to surrounding structures—always a risk with water—and leaves no mess so that work on repairs can be resumed immediately.

Also, most important with large fires, it is possible for the operator to walk straight up to the blaze with the steady stream of powder providing a safety-curtain.

Fire chiefs and others with long experience in fire-fighting have expressed amazement at the efficiency of the Waterloo dry powder range of extinguishers, which varies from 7 lb. to 150 lb. capacity models. Apart from their value in the gas industry, they smother electrical fires with lightning speed, and are highly efficient in dealing with fires involving oils, spirits, wax, paints, and similar inflammable materials.

The powder is non-caking; it is dry and stays dry, and therefore flows freely, covering a large surface area; and it is non-toxic, non-corrosive, a non-conductor of electricity, and does not freeze. The extinguishers are fully approved by the Fire Officers Committee and all competent authorities in Britain.

New Pyrene Pressure Extinguisher can be Operated with One Hand

Squeeze Grip Valve Gives On-off Control

AMONG the latest developments of the Pyrene Co. Ltd. is their new P.40 pressure-type fire extinguisher. This model is pressurised by nitrogen and is easily and quickly recharged from a storage cylinder. The threaded discharge nozzle serves also as the connection for pressurizing.

The extinguisher is effective against motor vehicle fires, and small petrol, paraffin, alcohol, and electrical outbreaks. A squeeze-grip release valve makes possible one-hand operation, and provides positive on-off control of the discharge of fire extinguishing liquid. Other features include a special locking device in the operating head, for guarding against accidental discharge, and a gauge for instant checking of pressure within the container.

The extinguisher is operated by pulling back the locking handle and pressing downwards on the lever of

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the squeeze-grip handle. The jet of extinguishing liquid can be stopped at will by releasing the handle. The charge used is Pyrene chlorobromomethane liquid. Pyrene fire extinguishing liquid is used in the P.42 Model which is otherwise identical to the P.40.

These models will be on show at next month's C.F.O.A./I.F.E. Exhibition in Torquay. Also to be seen there will be the Pyrene in-line foam inductor, a device comprising a foam inductor fitted to the hinged lid of a portable foam compound tank of 15 gal. capacity, placed in the line of the delivery hose at a distance of 100 to 200 ft. from the foam-making branchpipe.

Also displayed will be the Pyrene mechanical foam engine (Model A.F.30C), a light appliance consisting of a 30-gal. container, charged with Pyrene pre-mixed foam compound; a 5-lb. CO_2 gas cylinder and 30 ft. of flexible high-pressure hose, terminating in a small foam-making branchpipe. The device is mounted on a light tubular steel chassis.

There will also be the Pyrene foam inlet box, an installation providing a built-in foam distribution pipeline system that enables a fire brigade to inject foam into a building from the outside, even if the building is locked and unoccupied; and the Pyrene 1-gal. hose reel foam generator, designed to provide a mechanical foam output through first aid hose reel units on fire engines. Models P.1 and P.O.2 (carbon tetrachloride) pump-type; P.32 and P.38 pressure-type; C.D.2½ and C.D.10 carbon dioxide; P.D.5, P.D.U.25, and P.D.M.U.25 (Pyromet) dry chemical types; Phomene F.1 and F.L.3 foam; and Conquest C.S.1 and C.S.55 soda-acid type will also be included in the show.

This Year's Safety Week Slogan will be

'EXTRA CARE STOPS FALLS'

OFFICIAL figures show that in 1956 22,548 persons were absent from work as a result of injuries following falls, equal to 14.1% of all reported accidents. And that figure does not by any means represent the total number of falls in industry, as it does not include any accident where a person was absent only for the remainder of the shift or day on which the fall occurred.

Even minor falls can cause a serious hold-up of production, for in addition to the injured person being put out of action, several others will inevitably cease work, either because they go to the assistance of the victim, or because the plant is necessarily closed down.

The prevention of falls is thus a matter of major importance to management and to all concerned with the country's prosperity, apart from the humanitarian aspect.

The Royal Society for the Prevention of Accidents feels that everyone employed in industry should be reminded that 'EXTRA CARE STOPS FALLS,' and has therefore adopted the slogan for this year's National Industrial Safety Week, which is to be held from September 29 to October 4.

The theme forms the basis of a nation-wide campaign directed to both managements and workers with the object of reducing the toll of industrial accidents, and particularly those associated with falls of persons. The campaign will have the active support of the 51 industrial accident prevention groups in the country, and as in previous years, valuable support from civic heads and chambers of commerce is expected.

To assist managements in organising their own campaigns during Safety Week the Society has prepared a more than usually attractive range of publicity material built round an attractive little figure called 'Humpty Bumpty.' In form like his famous predecessor 'Humpty Dumpty,' he sits on a wall, but instead of falling he sits tight with a cheerful grin and on posters and in pamphlets and leaflets reminds everyone that 'Extra Care Stops Falls.' He will be even more popular than 'Sergeant RoSPA,' who identified last year's campaign.

As a further encouragement to workers to interest themselves in the campaign, the Society has prepared a special poster slogan competition for which £100 is offered in prize money.

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80,000 Hours Without an Accident

EIGHTY thousand hours—to be exact, 82,102 hours—without an accident is the proud record of the Bradford Road works of the North Western Gas Board in Manchester for the month ending on May 25 (the end of the costing period).

The hours, of course, are 'man hours.' And one-fifth of the total worked in the Manchester Group are put in at Bradford Road, which is one of the biggest works in the Board's area.

The 80,000 accident-free man hours are possibly an area safety record. The whole works is 'safety-conscious.' The causes for those most common of all accidents, falls and trips, are carefully watched, and, where possible, eliminated.

WELDING FABRICATION

Some Aspects of Application and Control

By A. M. HORSFIELD and R. P. NEWMAN

SEVERAL safety factors must be taken into consideration in relation to the use of welding. There are for example the various precautions necessary during actual fabrication to safeguard health; hazards to health are also carefully guarded against when employing radiographic methods for the examination of welds.

This article, however, is concerned with the safety of the structure in so far as this might be effected by the application of welding. In a general sense, structural integrity is attained through the exercise of informed design knowledge, the correct choice of material, the control of workmanship and the proper deployment of inspection.

Interdependent

These are often regarded as separate issues, whereas in fact they are interdependent to a large degree. However, it is not intended here to attempt any treatise on design, but to review some of the practical aspects of arc welding fabrication and to deal, in particular, with the problem of stress corrosion which is of considerable importance to the gas industry.

Any review of general construction practice in the gas industry would have to make reference to a wide range of fabricated structures such as building frames, including tubular work, tanks and vessels, and pipe lines designed for various duties. It is clear that no single standard or code would embrace this field since ultimate quality must be measured against service duty and the possible consequences of failure.

In practice, of course, the various types of structure mentioned above are in the main constructed by specialist firms, and design and fabrication procedures can often be appropriately related to existing individual standards, such as, for example, B.S.449 in the case of structural work or B.S.1856 for cooling tanks. Nevertheless, this fact does not preclude a general examination of the problems of control and quality requirements since, however varied these problems might be, recognisable principles are often involved.

It is today regarded as an axiom that the control of welding should start at the design stage in the drawing office. At least, one must assume it to be so regarded since this statement has been made with regularity at conferences, symposia, summer schools and the like during the post-war, and even the pre-war, years.

On the other hand, ignorance of this principle is still so widespread that the conference resolution appears, in retrospect, almost to have been one of convenience rather than intent. The probable truth is that such a generalisation makes light of the undoubted practical difficulty of acquiring the necessary knowledge in the drawing office of those aspects of welding control which are the proper responsibility of the design staff.

Opinions may differ in defining these responsibilities but one may cite weld detailing as an example where drawing office practice is widely variable in skill. Fundamentally the problem has its main roots in education and whilst laudable efforts are being made to put across welding design, as, for example, in the preparation of a handbook by the Institute of Welding, it would seem that progress beyond the fringe of the solution will not be made until welding technology becomes something more than extra-curricula in technical education.

Supervision Needed

If it should start in the drawing office, welding control should certainly not stop there. Clear instructions may be a prime requisite, but they are meaningless unless they are properly executed and known to be so; it follows, therefore, that adequate supervision is necessary. The need for this continuation of control becomes self evident if one considers some of the factors which have to be prescribed in order to translate a design requirement into practical achievement.

The initial design stages will certainly involve a consideration of the general type of joint to be used, in which the loading conditions and the location of the joint with respect to loading, accessibility for welding and possibly inspection will have been taken into account. Beyond this point, however, procedural control is vitally necessary in matters such as the preparation of material for welding, the accuracy of fit-up before welding, the choice, and use, of the correct type and size of electrode, and, where necessary, the application of pre-heating and maintenance of inter-pass temperature.

Further, conditions may arise where these factors are wholly or partly influenced by the position and sequence of welding and so, ultimately, by the manufacturing facilities available. This brief description is intended to do no more than underline the continuous control link from design to manufacture which should exist, however it might be administered.

Wider Aspects

It has already been stated that ultimate quality must be measured against service duty and the possible consequences of failure. In the field of welded construction the conception of quality is sometimes simply related to the assessment of the condition of joints in respect of the presence or absence of internal weld defects.

Defects of this kind can, of course, influence the strength of a structure, just as it is equally true that certain defects have no such influence, and this point will be returned to later. There are, however, wider aspects to the subject of weld quality.

Assuming metallurgical soundness, including freedom from internal defects, welded joints can still give rise to stress concentrations. These stress concentrations may have their origin in design or in workmanship, but whatever the cause they cannot be neglected when measuring the required quality against a service duty which involves, for example, fatigue loading. Similar considerations may apply to other working conditions where the simple conception of weld quality is too narrow.

Having made this general qualification the problem of weld quality requirements, in the sense usually

implied, may be examined. There can be no doubt of the existence of the problem since demands for an acceptance code, defining tolerable limits for weld defects, are made with considerable frequency, mainly as a consequence of the increased use being made of the various methods of non-destructive testing, especially in those fields where it is thought that a quality level less than that of Class I pressure vessel construction should be acceptable.

The high standards of Class I construction probably have no easily definable origin other than the collective resolve of manufacturers, insurance companies and users to avoid a failure, the consequences of which could be serious in the extreme. There is certainly no origin of comprehensive investigation, the results of which could in any way be extrapolated, even if this were possible.

Because of this it is often thought that the production of general acceptance codes is a responsibility of welding research. A more valid demand on welding research would be for information of the influence of defects on joint strength and this must be accepted as one of the major industrial needs of the present time.

The problem of determining the influence of defects by experiment is, however, by no means a simple one. Even if the permutations of weld defects, defect severity and defect location were regarded as but one factor, this would have to be multiplied by factors such as type of applied stress, residual stress, temperature and so on, in any programme which purported to be comprehensive.

Selective Research

It is clear, therefore, that the application of research will have to be selective to a high degree in this vast area of a problem and must serve essentially to augment rather than supplant personal judgment for some considerable time. It will be noted that the acceptance of the problem to this extent assumes no difficulty in the orderly production of defects for study, but which is yet a problem in its own right.

The determination of the influence of weld defects has not been entirely shunned by research workers. Most of the early experiments were confined to the static loading of defective welds and it was soon established that this kind of test was relatively insensitive to the presence of many, and sometimes quite severe, defects.

A more refined investigation of this type in which the influence of porosity in mild steel weld metal has been re-examined has recently been undertaken.[1] The properties determined, for different amounts of porosity, were ultimate tensile strength, tensile elongation and bending elongation, and it was found that the cross-section of the welds tested could be reduced by porosity up to about 7% without materially changing the mechanical properties measured.

Substantially the same behaviour was recorded in impact tests on Charpy V-notch specimens cut from the porous welds. Impact tests have also been carried out[2] on mild steel plate specimens containing transverse butt welds with included defects such as slag inclusions and cracks not exceeding 9% of the cross-sectional area of the plate.

Different Approach

These tests were done at room temperature and failure of the plate in a ductile manner, remote from the defective joints, was obtained. It is not surprising that results of this kind have brought about a different approach to the problem in which fatigue testing has been, and is being, used as a more critical test method, even though it is recognised that fatigue loading as such may not always be relevant to the practical application.

The investigations in which the fatigue testing of defective joints has been employed are not too numerous, but space would not permit a detailed review here. Such a review will be published elsewhere[2] and for the purpose of the present discussion it may be noted that such tests have indicated that there are positive tolerable levels for defects such as porosity and slag inclusions in metal arc welds subjected to axial loading.

Cracks and lack of penetration orientated in a direction normal to the applied stress are certainly dangerous, but the latter defect probably has little influence when it is parallel to the direction of stressing. An investigation of this kind which is possibly of more direct interest to the gas industry was concerned with the valuation of the influence of defects in circumferential butt welds in mild steel pipes.[3]

In this case it was shown that for joints welded from one side only, the condition of the joint root was of over-riding importance to an extent that any influence from quite severe defects in other zones was completely masked.

One of the personal hazards to be faced in producing experimental data of the kind referred to above is the charge that any work which shows defects sometimes to be innocuous encourages faulty workmanship. Pushed to its logical end the implication here is that 100% freedom from weld defects is necessary.

The need for the highest possible standard may well exist in connection with certain atomic energy or chemical processing constructions, but, otherwise such a demand would be very largely unrealistic. This is not to say that good workmanship need not be encouraged; it is recognised that it should and to this end the British Welding Research Association have published a memorandum[4] in which typical faults in arc welds in mild and low alloy steels are defined and illustrated, and reasons given for their occurrence together with an indication of the ways in which they may be avoided and corrected.

Let us assume our welded items have been constructed free from cracks and reasonably free from internal defects such as porosity and lack of fusion at the root of the weld.

Most items of gas plant are not called on to withstand extreme temperatures, pressures, or loads, neither are they likely to be subjected to pulsating stresses: Is it, therefore, permissible for the items to be taken to the site and erected in the 'as-welded' condition?

Before answering this question it is necessary to consider the change in the physical state of these items resulting from the welding operation. The fusion welding process gives rise to localised heating and cooling in addition to the shrinkage contraction which occurs when the molten weld metal solidifies. Since the weldment is under restraint residual stresses of considerable magnitude form in the region of the weld.

Localised Attack

The importance of these stresses in gas plant is due mainly to the presence of corrosive liquors in the purification stream. This combination of stress and corrosive environment results in a form of localised chemical attack on the steel surface known as stress corrosion.

The attack is most severe in the regions of highest stress, i.e., near the welds, and results in the formation of small cracks which may run either parallel to or across the welded seam. These cracks form on that surface of the component which is in contact with the gas liquor and after a suitable period of time, which depends on prevailing conditions, they penetrate to the outside surface.

The cracks are usually up to about 2 in. in length and are first seen when

liquor begins to seep through and run down the outside of the affected part. The time taken for failure to become apparent might be anything from a few months to a few years.

Much work has been done on this subject in the past ten years and a description of the numerous surveys and laboratory tests has been published elsewhere.[5, 6] It has been shown[6] that the main constituents of gasworks liquor which lead to this form of attack are ammonia and hydrogen cyanide in the presence of either carbon dioxide or hydrogen sulphide or both.

In a series of laboratory experiments cracking of stressed mild steel specimens was obtained in solutions of this type in which the compositions were of the same order as those found in the purification stream of a gasworks.

Simple Remedy

Stress corrosion cracking can occur anywhere in the purification stream up to and including the ammonia scrubbers but is most pronounced near the foul gas main where the temperature and ammonia concentration are both high. Fortunately a simple remedy has been found whereby failures of this type can be entirely eliminated.

It has been shown that if the residual stresses in a component can be reduced to a half or less of their 'as welded' value then the component in question will be immune to stress corrosion cracking. Before items are erected on site it is therefore desirable to carry out some form of stress relieving treatment if premature failure is to be avoided.

By far the most satisfactory method of stress relieving welded mild steel items is by means of a furnace annealing treatment. In this method the welded component is held at a temperature of 450-500°C. for one hour in the furnace and then cooled. To obtain the best possible results the rate of heating and cooling should be within certain limits.[7]

No Failures

Many items of plant treated in this way have been put into service in the past ten years and so far no failures have been reported even in plants which previously had a bad history of cracking.

In local low temperature stress relieving (Linde process), a localised heating is carried out on regions either side of the weld using oxy-acetylene burners of the type used for flame-cleaning steel plates, the idea being to obtain a temperature differential of about 120°-200°C. between the centre of the heated zone and the weld.[9]

The burners move along the seam at such a speed that the temperature differential is maintained and a few inches behind the burners is a water spray to cool the heated regions. The object of the treatment is to cancel the stresses produced by welding by putting reverse stresses of equal magnitude into the correct regions.

The process works very well if the welds are long and straight and the operating conditions are correct. The danger here is that if the conditions are not correct (and they are quite critical) then matters may be made worse because the stresses have added to the welding stresses instead of reducing them. A further disadvantage of the process is its unsuitability for treating fillet welds.

Both hammer peening and shot peening have been shown to be effective[5] if properly carried out.

To summarise the methods of stress relieving available it can be said that the simplest and most effective is a furnace treatment at 500°C. Large items such as condensers, scrubbers or detarrers may be too big for the furnace capacity available and the best solution here is to split them into two or more flanged sections which can be bolted together on site.

Well Established

Since it is now well established that stress relieving of all gas plant in contact with liquor (including storage vessels) is essential this factor should be borne in mind at the design stage.

If the Linde process is to be used at all successfully the component must be designed with this in mind because long straight seams or circumferential seams are the only ones suitable for this treatment.

Hammer peening and shot peening are quite effective and can with advantage be used where the other processes are unsuitable as, for example, in the case of treating welds which join fittings to components already stress relieved by other methods.

An important point to remember is that once a component has been stress relieved no further welds should be made on it otherwise it will be necessary to carry out a further treatment. It would for example be useless to furnace stress relieve all the separate items of gas plant in the manufacturers works, transport these to the site and then permit the contractor to assemble them by welding. Unless given a further stress relieving treatment on site the new welds would eventually crack in service.

The aim should be to design the plant in such a way that the welded items can be treated before they are assembled on site, no further welding being required during their erection.

It is hoped that the papers presented to the Institution of Gas Engineers[5,6] will have convinced all concerned that to insert 'as welded' items into the purification stream is to invite trouble in the form of stress corrosion cracking at some future date. If the gas board, gas engineers and contractors always specify stress relieved equipment in the future then the question of how to repair cracked items should, in a few years time, become a thing of the past.

Unrecognised

In a report to the Institution of Gas Engineers[5] published in 1951 it was concluded that immunity from cracking could be obtained by stress relieving at 450°C. for one hour. Unfortunately it was thought at that time that cracking was confined to certain well defined regions in the purification stream but a subsequent examination of more than 90 plants showed that cracking had occured in other regions but had not been recognised.

An examination of other gasworks where 'as welded' components were in use and where no cracking had been reported showed that cracking had taken place but had not been recognised by the gas engineer concerned. A possible explanation of this is that in certain parts of the plant the liquor may continue to seep through once a crack has formed thus causing large deposits to form on the outside surface of the affected part.

In other cases a small amount of deposit might form and stifle further attack until the crack widened from the inside and seepage began again. In the latter instance the initial stage might not be recognised unless the main was carefully scrutinised at close range as for example if it was being painted.

Need Emphasised

The results of these subsequent examinations emphasised the need for stress relieving to be applied to other items in the stream excluded in the first report to the I.G.E. These further points together with confirmation of the effectiveness of the furnace treatment have been published in a paper to the I.G.E. 23rd Autumn Research Meeting in 1957[8] and it is hoped that this report will have convinced even the doubters that the disease exists and reassured them of the effectiveness of the suggested remedy.

Returning to the present problem of

how to deal with 'as welded' plants which show cracking and will presumably continue to do so until replaced by stress relieved ones there are several ways of dealing with the problem.

If the affected part is small and the cracking severe the cheapest and most satisfactory solution is to replace it by a stress relieved part.

If the part is large, or is unacceptable because of the cost, then some form of repair is necessary. The simplest method is to weld up the cracks and then stress relieve the weld by peening or possibly by the Linde process.

It is obviously useless to weld up the crack and omit the stress relieving treatment because although it will stop the leakage temporarily and prolong the life of the component, cracking will again appear and the process will have to be repeated.

Another method which has been used is to bolt a steel strap over the cracked area using a suitable backing material. This will apparently stop the leakage but there is a very real danger that the cracks will continue to extend unobserved under the strap. In severe cases this might continue until eventually collapse took place particularly if the weld was a circumferential one horizontally disposed.

A method somewhat similar to the above has been reported[8] in which the leaks are repaired by using epoxy or polyester type resins reinforced with glass cloth. Some success has been reported in the use of these materials but again care must be taken to ensure that the cracks do not propagate unobserved and regular inspection of plant repair in this way is advisable.

It should be noted that strapping or sealing with resins will stop leakage but will not restore the mechanical strength of the component. Where this is in doubt one of the other methods should be used.

The foregoing remarks apply to the normal constructions used in gasworks plant, coking plant, and liquor storage vessels. Special constructions for use at high temperatures and pressures will demand more stringent specifications to be followed during welding and subsequent stress relieving.

The Authors wish to thank the Director of Research of the British Welding Research Association, for permission to publish this article.

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[8] Norris and Riley—paper in the Gasworks Coking Section dated March 5, 1955.

[9] Parkins, R.N., 'Some Experiments with the Linde Process.' B.W.R.A. Report to be published 1958.

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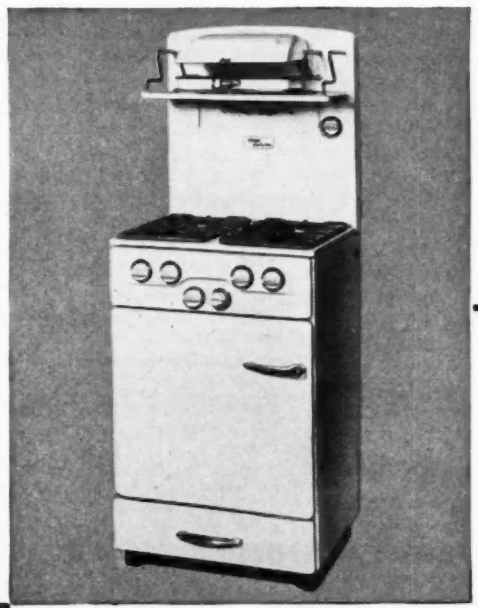

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* *The Adonis is available in Cream, White Blue or Green vitreous enamel finish*

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W68

SAFETY FOR THE MAN WORKING ALOFT

AMONG the equipment extensively used on maintenance work in the gas industry there are three products of outstanding merit, made by W. C. Youngman Ltd., of London and Crawley. A bo'sun's chair, a set of adjustable roof crawling boards, and a working platform known as lightweight staging.

The bo'sun's chair, as a matter of fact, was originally conceived and patented by a member of the North Thames Gas Board and, incidentally, the British Standards Institution was so impressed by the merits of the design that it was accepted to form the basis of the new B.S.S. 2830:1957. The manufacturers also acknowledge the immense contribution Mr. A. G. Palmer, the Design Office Manager, and his colleagues, of the North Thames Gas Board, have made in the development of their roof crawling boards.

Bo'sun's Chair

The expression bo'sun's chair is of such nautical flavour that few people realise its application to industry; indeed the British Standards Institution spurn the name and refer to this equipment as a suspended safety chair. No matter what the pundits may call it, the practical man in the trade will for ever recognise it by its colloquial name.

Once upon a time the bo'sun's chair was simply a piece of flat board suspended from each end, safe enough perhaps so long as one hand held tightly on the rope but a risky piece of equipment for the man who needs two hands to do his job.

The modern counterpart. as the illustration shows, is a comfortable seat having a continuous back rest like an arm chair and with an upstanding support to carry the suspension point situated between the operative's legs so that complete safety is assured without the need of safety belts or straps yet leaving both hands free. Costly scaffolding can often be avoided and considerable saving made on the maintenance of steel chimneys and gas holders by this piece of equipment.

Crawling Boards

Statistics reveal that every year some 30 workers are killed and some 200 injured, most seriously, by falling through fragile roof coverings, more often than not through the use of improvised cat-ladders or duck-boards. So tall are many of the buildings in a gasworks that the safety aspect of workers engaged on roof maintenance is a matter of supreme importance and Youngman roof crawling boards are claimed to be the answer to this problem.

Light and easy to handle, they can be carried by hand to the top of a long ladder without undue effort. Adjustable so that they are suitable for roofs of different lengths and so designed that they may be used from a valley gutter just as easily as they can be suspended from the ridge to the eaves.

So simple are these crawling boards to use that there is no longer any excuse for men engaged on roof work to 'take a chance,' neither is there the need for the safety officer to insist on their use on every occasion for men like them and are comforted by the feeling of security they give to what otherwise might be extremely hazardous work.

We are all conversant with the commonplace 1½-in. by 9-in. scaffold board and the safety regulation in the building industry which states that it must be supported at no more than 5-ft. centres. The introduction of Youngman Lightweight staging has changed all that. Scientifically designed and made from prime quality ladder stock, reinforced with high tensile steel wire, these stagings, which are 18-in. wide, are designed to span their full length without intermediate support.

Little Movement

Bearing in mind that they are available in all lengths up to 24-ft. their immense value on maintenance work can be instantly recognised. Spanning from truss to truss for interior roof painting or repairs they virtually eliminate the need for any other scaffolding. On the ground, suspended on painters trestles, since they span so much further than scaffold boards, there is little floor obstruction and they minimise the movement of equipment.

Personal Notes

MRS. EILEEN MURPHY is to retire from the Gas Council at the end of December. She joined the staff of the British Commercial Gas Association in January, 1924, as a clerk to help in connection with the Empire Exhibition held at Wembley; later she was in charge of the Association's reception room and the correspondence files. It was in this capacity that she became seriously interested in gas and salesmanship and she determined to create a career for herself in the gas industry. In 1932 she won the Goodenough Gold Medal awarded for the best paper of the year to the Salesmen's Circles. It was entitled 'Women and Domestic Gas Sales.' In 1934 she won second prize in a world-wide competition sponsored by West's Gas Improvement Company for a paper on 'Gas in the Home.' First prize went to a male competitor in Canada. In 1934 Mrs. Murphy was appointed Director of Home Service to the B.C.G.A., a position she held also with the British Gas Council and now holds, as Home Service Officer, with the Gas Council. She took courses in journalism and public speaking and has had a number of articles and short stories published in newspapers and magazines, and broadcast; published a history book entitled 'Our Last 2,000 Years—An Irishwoman's History of England,' a booklet, 'New Kitchens for Old' [which proved a Walter King best-seller], and several leaflets on fuel problems and other subjects; has lectured to audiences in all parts of the country and has broadcast for the B.B.C. on radio and television. In 1937 she was sent for several months to America and Canada to study sales conditions there and she presented a paper at the B.C.G.A. Annual Conference in 1937 on 'Some Aspects of Gas Sales and Service in America.' She visited America again in 1939 for the New York World Fair. From March, 1940, to the end of the war she was organiser of the gas industry's part in the Government's nation-wide 'How to be Fitter though Rationed' campaign. From 1943 to 1949 she was Secretary of the British Gas Council's Domestic Development Committee, Technical Sub-Committee and Joint Consultative Committee—the main work of which was to co-operate with the many Government departments concerned with post-war reconstruction; in particular housing, incorporating improved heat services, ventilation, insulation and planned kitchens. In July, 1950, she was appointed Secretary of the Gas Council's Commercial Managers' Committee and in November, 1950, Secretary of the Joint Consultative Committee with the Society of British Gas Industries. She is an Associate of the London and Southern Junior Gas Association and was the first woman to be elected, in June, 1951, an Associate of the Institution of Gas Engineers.

MR. W. E. PRESTON has been appointed by Foxboro-Yoxall Ltd. to their staff of technical representatives. Mr. Preston will cover Northumberland, Durham, Cumberland, Westmorland, and the Middlesbrough area of Yorkshire. His address is 49, Ivanhoe, Whitley Bay, Northumberland. Telephone, Whitley Bay 21366.

MR. C. R. AUSTEN, Officer in Charge of the meter laboratory at Watson House, is due to retire from the North Thames Gas Board on February 1, 1959. From that date he is taking up an appointment as Research Controller of the meters division of United Gas Industries Ltd.

Obituary

MR. HARRY E. CHANCELLOR, who recently retired as Regional Sales Manager of Parkinson Cowan Gas Meters, died on August 7.

CORRESPONDENCE

Does Our Industry Make the Best Use of Manpower?

DEAR SIR,

Are we making the best possible use of our manpower resources in the gas industry?

What has made me seriously consider this matter is a recent article on 'Work simplification' in an American journal on factory management.

What impresses me most (as an employee) about the work simplification method is that it calls for the active participation of all employees at all levels. Briefly, work simplification sets out to stimulate each worker to participate with his fellow workers and available experts, resident or brought in as consultants, in improving methods in his own department. The argument is that new procedures can only be effectively introduced when personnel wholeheartedly participate in developing such improvements themselves.

From the employee's point of view the philosophy of work simplification is the right one—namely that people are all important. Hence the insistence on participation and consultation at all levels.

How often do we find such a philosophy in British management? I agree there are a few enlightened exceptions but in the main I feel the British emphasis is on techniques and not sufficiently on enlightened human relations.

In Britain, despite the introduction of new techniques, the worker derives little additional benefit—in terms of greater satisfaction from his job. This is mainly due to an uninspired and unimaginative managerial approach. Management on one side—workers on the other. Rarely is there a unified team approach to generate the right kind of enthusiastic attack on problems common to the industry concerned. Too often, the only 'channel' available for employee initiative and originality is the suggestions scheme.

Hence the all too common (and, in the circumstances, understandable) attitude: 'I've no interest in this job or this industry. It's only the pay packet I'm interested in.' This is a particularly unfortunate state of affairs in nationalised industry where (presumably) from general managers downwards we are at least 'equal' in our status as public servants.

It seems to me we could benefit greatly in Britain from cultivating this enlightened American approach to management problems. With us (in too many instances), 'joint consultation' is but a token ritual. Our management experts (whether resident or brought in as consultants) work too much in isolation. The prevalent practice of picking the brains of experienced and skilled personnel (naturally) causes resentment, whereas genuine collaboration and participation by all ranks would generate enthusiasm and would almost certainly produce a more effective solution to any problem.

In recent years we have seen the mushrooming of various schools of thought on administrative planning. Undoubtedly they have thrown up many brilliant and worthwhile ideas. The exponents of work simplification argue that, in conjunction with an enthusiastic team of workers, they could do even better. They deplore what they call the 'experting' of problems. They say in effect: 'Let's get together everybody involved in this particular problem and let us work as a team to find the best solution.'

There is a dangerous tendency to make the study of organisational problems an end in itself. As work simplification emphasises, people are all important and personnel in any organisation are only irritated and bewildered by academic jargon and abstractions more suited to a research thesis. Work simplification effectively disperses this academic fog by bringing the expert out of his backroom and into contact with the man with the problem—the idea being not that the former's brains are better than the latter's but that together they are much more likely to come up with an effective solution.

I hope we shall hear a lot more of work simplification in this country. I for one like the sound of it very much indeed.

Yours faithfully,

Scotland NOR'EASTER

August 9, 1958

The Scottish Gas Board is out to give the best possible service at the lowest price, Mr. Sydney Smith, Chairman of the Board, told the 200 guests at the luncheon in Glasgow City Chambers on the occasion of the inauguration of the Provan extension described in these columns last week. But much would depend on whether the Government took steps to halt the present inflationary spiral, he added. Pictured above, the Lord Provost of Glasgow, Mr. Myer Galpern, who officiated at the ceremony, replies to the Chairman's toast to the City of Glasgow at the luncheon. Also in the picture, reading from the left, are Mr. D. D. Melvin; Colonel Patrick Thomas; Mr. D. D. Burns; Mr. Sydney Smith; Sir Patrick Dollan, and Mr. H. R. Hart. Members of the Board also present included Lord Geddes, Lord Mathers, and Sir Robert Nimmo. Other guests included Mr. Thomas Johnston, the Earl of Balfour, Sir John S. Pickles, Mr. R. W. Parker, General Sir Gordon MacMillan, and Sir Francis Tudsbery.

GAS COUNCIL URGED TO MAKE COKE ATTRACTIVE

SALIENT points of the annual reports of the Industrial Coal Consumers' Council and the Domestic Coal Consumers' Council for the year ended June 30, 1958, are:

Industrial Council—to examine the supply position and recommend more briquetting to help offset the shortage of large coal; to refer to the N.C.B.'s difficulties in disposing of large stocks of small coals and note the measures being adopted by the Board to adjust the balance between the supply and demand for the different sizes of coal; to consider the price incentives to industrial consumers to adjust their demands for different sizes of coal; to stress the continuing need for more fuel efficiency; and to approve the principle of financial inducements to consumers to stock more coal in the summer.

Domestic Council—to comment on the Government's decision to decontrol coal; to comment on changes in the summer/winter prices scheme; and to welcome progress made by the N.C.B. in the cleaning of house coal.

The Council have also suggested to the distributive trade how merchants might be more helpful to their customers; and have taken up with the Gas Council the need to make coke more attractive to householders. They are also to consider the merits of different types of solid fuel burning appliances and suggest how some can quite cheaply be made more efficient.

Calling all Gourmets

THIS year a record number of Britons are taking their holidays abroad. They will come home with memories of wonderful Continental meals.

But these memories can be made into realities: For, in a large central exhibit at the Food Fair at Olympia from August 28 to September 11, the Gas Council will be erecting 12 ultra-modern kitchens, staffed by experts from 12 nations, who will show visitors the delights of their native dishes using ingredients readily obtainable in this country.

The exhibit, the largest in the show, is called 'International Kitchen.' Many of the cooks will be in their native dress and all the dishes will be prepared according to authentic recipes, details of which will be available to take away. Gaily decorated kitchens will add to the brightness of the scene. There will also be a special 'International Kitchen' cookery book on sale at the fair, price 2s.

Those staffing the kitchens will be drawn largely from embassies, legations, and high commissioners' offices.

Stud Welding

The article on stud welding which appeared in our last week's issue was attributed to Mr. John Grindrod in error.

W.G.F. MEMBERSHIP ROSE BY 800 DURING LAST YEAR

TOTAL membership of the Women's Gas Federation at termination of the year ending March 31, 1958, was 16,052 in 141 branches, the annual report for that year reveals. This represents an increase in membership of 803 during the year. New Branches were opened during the year, at Abbey Wood, Bootle, King's Heath (Birmingham), Newbury, Smethwick, Walton (Lancashire), and Yeovil.

Two area conferences were held during the year—the West Midlands, in Birmingham; and the North Thames, in Kensington, London. Four branch officers' courses were held which were attended by 390 officers and committee members from 24 branches.

More than 100 students took the Women's Gas Federation examination—17 in the summer of 1957 and 90 in the spring of 1958.

During the year the Federation was also represented on the Council of Scientific Management in the Home, the Institutional Management Association Council, the National Housing and Town Planning Council, the National Institute of Houseworkers Advisory Council, the Royal Society for Prevention of Accidents (Home Safety Committee), and the Women's Group on Public Welfare.

In connection with this report, we inadvertently gave details of the attendance and proceedings of the 1957 meeting in our July 30 issue.

WHAT IS A GOOD EMPLOYEE?

A Special Correspondent Writes a Thought-provoking Article of Vital Interest to a Nationalised Industry

SINCE the end of the last war, we have read and heard a great deal about what is expected of management, about their duties and obligations. And rightly so; because upon the efficiency of British management in the years that lie ahead depends the livelihood of all of us. Management must not resent this tremendous amount of attention which is focussed on it. Any worthwhile job must be continuously examined in order to see whether it is done to the best advantage of all concerned. Furthermore, those who aspire to, and acquire, the status of management must expect a great deal of limelight. They are at the top. They are in an exposed position. Competition is keenest and more formidable at that level. They are the leaders. From them must primarily come the thrust and drive, the lively imagination, the inspired anticipation and planning of future policies.

But it is a two-way traffic, this question of making a success of business. Has there not been too much expectation that management must do everything, carry all the responsibility? After all, the manager is only the head of a team, and can do next to nothing if the members of that team are dull and apathetic or indifferent. They too have their responsibilities, and very real ones at that. When things go wrong, when progress is retarded or negatived, it is seldom the fault of one man. The whole team must bear the responsibility to a greater or lesser degree. Employees cannot expect to be in a team and not of it. They cannot complain that they have no sense of belonging, unless each one of them contributes to the common pool of well-being of the firm by whom they are employed.

Balance Needed

It would be refreshing and timely, therefore, to consider what constitutes a good employee. There must be a sense of balance in these things. There is far too exclusive a concern among certain employees about their rights and privileges, and too little concern about their obligations and duties to the employer who employs them and pays them for what they do, as well as accepting a great deal of social responsibility, laid down by Acts of Parliament and otherwise, for their general welfare and security.

The employee cannot really expect good treatment if he is indifferent to the welfare of the undertaking by whom he is employed. He must realise that denigration of the undertaking which employs and pays him merits the severest discipline. Disloyalty and ingratitude stamp him as a not too valuable employee. There is throughout the Anglo-American Productivity Reports an astonishing consistency of emphasis that the American employee is absolutely loyal to his firm. He thinks it is the best in the world. He realises that it is competing to retain its very existence, and that it is up to him in every way to ensure not only the firm's survival but its continuous and increasing strength to meet competition from every quarter.

He also realises that every industrial concern must be always dynamic and never static. You cannot equate a lively and progressive firm with a cemetery. Change there is and always must be. A good employee must not only not oppose it, or obstruct it in any way, but actually welcome it. Among American employees generally, there is an ever-present readiness to try new methods, new processes, new machines, because all these things mean progress, and progress means increasing prosperity, not least to the employees themselves. He does not immediately jump to the conclusion that any of these things necessarily involves redundancy. He is aware that the whole of industrial history points to the fact that new inventions and methods of production have usually meant more employment, not less—and an ever-increasing improvement in the standard of life.

Faith in Management

A good employee will not, therefore, retire into unenlightened lack of co-operation or into a morass of unreasoning fear, allowing himself to become a prey to ill-considered rumours and gloomy forebodings. He will prefer to have faith in the management whom he has learned to trust and respect. He will want to be a valued member of the new scheme of things. He will be eager to show his adaptability and to prove that he too is dynamic and enamoured of an adventurous attitude towards his employment and his own capabilities.

The one certain way for an employee to ensure his own lack of security is to be wedded to outworn attitudes, to old habits, to rigidities of methods and practices. The employer can employ only the employees whose skills are needed for the type of production prevailing at any given time. For the purpose of transport, for example, he no longer needs horse drivers, but those with the ability to drive a lorry or some other internal combustion vehicle.

Some employers have set down in writing what they require from employees. One engineering firm calls it : 'Your side of the bargain.' The firm says that they expect a fair day's work for a fair day's pay, because without that neither a company nor its employees can prosper. The firm expects employees to respect the company's property, whether buildings, machinery, tools or anything else; because they all have to be paid for out of the money the company earns from the products it makes and sells. It also expects employees to conform to the rules which management thinks are necessary for the efficient conduct of business, including Factory Rules and Health provisions. A good employee will also avoid taking advantage of the legislation governing health and accidents by

staying away for only slight ailments. He will realise that a high degree of absenteeism—the coal industry, for example, is cursed with it—is a grievous burden on the firm's finances and often adversely affects the interests of his colleagues who stay at work.

Where there are suggestion schemes—and most progressive employers have them—he will support them at all times. He will take an active interest in the operation of his job, and if he has any ideas as to how the operation can be improved and expedited, he will bring them quickly to the notice of management for his own benefit (suggestion schemes provide for awards in the case of constructive and practicable suggestions) as well as for the benefit of the undertaking which employs him.

Joint Consultation

He will regard joint consultation for what it is: Joint deliberations between representatives of employers and employees as to how to improve the health, welfare and safety of employees and the general efficiency of the undertaking. He will be prepared to serve on joint consultative committees and give them the best service he can. He will avoid using them for the ventilation of petty personal grievances, or as a means of getting his own back on management. He will listen attentively when management reports on the trading position of the undertaking and suggest from his own experience and observation ways and means of arresting any decline in business and of helping to convert that decline to a vigorous and positive increase.

He will appreciate that sound undertakings have to put money to reserve for depreciation and replacement of machinery, have to pay for raw materials—in the case of the gas industry for coal which, since the end of the war, has steadily depreciated in quality and greatly appreciated in cost. He will know that the customer is the person ultimately to be satisfied, and that there is no obligation upon him to purchase the firm's products; he will do so only if the quality and the price are competitive. This is as true of gas and its by-products as it is of any other commodity. The gas industry is no longer a monopoly wherein employees can take their ease and be no longer open to the keen and vigorous winds of competition.

The good employee will take full advantage of the ample facilities for education and training provided at great cost and trouble by a good employer such as the gas industry. He will not sit back and moan and groan because he does not advance sufficiently quickly. Is he satisfied that he is sufficiently trained and qualified to undertake the new responsibilities that promotion always entails? If not, the good employee will ensure that he is. He will be prepared to devote his spare time to the acquisition of such skill and knowledge. Indeed, he will consider that the acquisition of skill and knowledge is worthwhile in itself, quite apart from any material advantages that might accrue therefrom. It will add to his self-confidence and to his personal efficiency whatever tasks he undertakes.

He will be concerned with the health and safety of his colleagues as well as of himself. He will not be a party to the spreading of contagious diseases, or to leaving articles lying about to the obvious endangerment of the physical safety of his fellow employees. He believes in orderly, clean and tidy surroundings and will do his best, and encourage others as well, to make and keep them so. And one aspect of this is punctuality in attending to his business. He will not be a chronic latecomer, nor will he be less assiduous in carrying out his duties when his employer's eye is not upon him. He will have a greater degree of personal responsibility than that.

An integral part of the tidiness and orderly arrangement of things is a proper conception of discipline on the part of the employee. He will revolt, and rightly so, against the tyrannical and unintelligible forms of it, as embodied in the type of boss who thinks power means throwing his weight about and intimidating people. Not only is that kind of control out-of-date, it never was in date among efficient and confident management. But discipline of some kind there must be. There must be some people who give orders and others who carry them out—and that requirement obtains in any kind of organisation and under every type of political régime. The good employee will, therefore, accept the inevitability and essentiality of discipline without question.

The right type of discipline is one which is constructive and not negative—which ensures that employees are not only shown the errors of their ways but clearly and patiently where they have done wrong, and the right way of doing things. The sensible employee in the face of such positive and helpful discipline will accept the advice proffered and profit by it. How else can he progress? He will not wish to dwell in error for the rest of his working life, unaware of his inefficiency because no one has taken the trouble to enlighten him about it. Furthermore, he will be aware that no one can be happy in a chaotic scheme of things. All of us are happy to work only in a well-ordered industrial organisation subject to intelligible and constructive rules and regulations.

The future of our industry—indeed of our country—depends on the responsible attitude adopted towards it by each one of us. If we are more concerned with our rights than with our obligations, if our attitude is one of indifference rather than enthusiastic and loyal participation, then in that measure we weaken and undermine the industry which provides us with our livelihood—and that applies from the topmost to the lowest level. But it is well to remind those of us who are not managers, that we also have our responsibilities and that it is our bounden duty both to our employer and to ourselves to carry them out to the very best of our ability. This needs saying to preserve a balanced and realistic assessment of industrial activity.

Chemical Plant Booklet

THE British Chemical Plant Manufacturers' Association has issued a booklet which describes the services offered by the Association to chemical plant manufacturers and to chemical plant users. It was produced on the occasion of the recent Chemical and Petroleum Engineering Exhibition. The booklet is primarily for the information of firms enquiring about membership. Such firms and other interested in the work of the Association may obtain copies free of charge on application to the Secretary of the Association, 14, Suffolk Street, London, S.W.1.